Research Product 98-38

A Catalog of U.S. Army Research Institute Products Developed From 1985-1998 for the Reserve Component

August 1998

Reserve Component Training Research Unit

U.S. Army Research Institute for the Behavioral and Social Sciences

U.S. Army Research Institute
for the Behavioral and Social Sciences

A Directorate of the U.S. Total Army Personnel Command

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14. ABSTRACT *(Maximum 200 words)*: This report provides a catalog of selected research and development (R&D) products produced between 1985-1998 by the U.S. Army Research Institute (ARI) for the Reserve Component (RC) (i.e., Army National Guard and Reserve). The catalog contains seven chapters. The first describes ARI and its mission, and then the RC, its organization and strength, and how its operational environment differs from that of the Active Component (AC). The next two describe products that use training aids, devices, simulators, and simulations (TADSS) to overcome individual/crew (Chapter 2) and unit/battle staff (Chapter 3) training time constraints. Chapter 4 talks about products designed to bring geographically dispersed soldiers closer together via distance learning. Chapter 5 describes the results of our efforts to understand and predict RC soldier attrition. Chapter 6 tells what we know about RC soldiers' reactions to being called up for deployment, and the feasibility of using a composite AC/RC unit for peacekeeping missions. The final chapter concludes with what we think is the payoff from the products described. The catalog's product summaries include why, how, and with/for whom work was done, what was found/developed, what the conclusions/implications are, and where more information can be found. In doing so, we hope to reveal not only what ARI has done up until now, but also the scope of what it is capable of doing in the future, to support RC R&D product needs of the 21st Century.

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FOREWORD

The mission of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is to maximize combat effectiveness through timely research in the accession, training, use, and retention of soldiers, and to support decision making by Army leaders through personnel performance and training research, development, and study and analysis programs. This mission extends to the Total Army, and thereby encompasses both the Active Component (AC) and the Reserve Component (RC) (i.e., National Guard and Reserve).

In performing this mission, ARI provides products of vital importance to both components as they seek to better understand, measure, predict, and enhance soldier/unit performance. These products are developed in response to expressed needs of sponsors and proponents, who are the initial beneficiaries. In addition, ARI's support for the Total Army includes technology transfer, technical advisory service, and the documentation of information for dissemination purposes.

This report is written to provide the military and behavioral research communities with a catalog of research and development (R&D) products produced by ARI from 1985 to 1998 with the potential for enhancing future RC readiness. We provide this report with the hope that it will reveal not only what ARI has done up until now, but also the scope of what it is capable of doing in the future, to support RC R&D product needs of the 21st Century.

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A CATALOG OF U.S. ARMY RESEARCH INSTITUTE PRODUCTS DEVELOPED FROM 1985-1998 FOR THE RESERVE COMPONENT

EXECUTIVE SUMMARY

Requirement:

Provide a catalog of U.S. Army Research Institute (ARI) research and development (R&D) products produced between 1985-1998 with the potential for positive future impact on Army Reserve Component (RC) (i.e., National Guard [ARNG] and Reserve [USAR]) readiness.

Procedure:

The catalog is divided into seven chapters. The first provides the context for the products to be summarized later by describing ARI and its mission, and then the RC, its organization and strength, and how its operational environment differs from that of the Active Component (AC). The next two describe products that use training aids, devices, simulators, and simulations (TADSS) to overcome RC individual/crew (Chapter 2) and unit/battle staff (Chapter 3) training time constraints. Chapter 4 talks about products designed to bring geographically dispersed soldiers closer together via distance learning. Chapter 5 describes the results of our efforts to understand and predict RC soldier attrition. Chapter 6 tells what we know about (a) RC soldiers' reactions to being called up for deployment, and (b) the feasibility of using a composite AC/RC force for peacekeeping missions. The final chapter summarizes what we think is the payoff associated with the products described. In most cases, product summaries include why, how, and with/for whom work was done, what was found/developed, what the conclusions/implications are, and where more information can be found.

Findings:

Overcoming Training Time Constraints – Individual and Crew Training. The products summarized in this chapter are designed to help the RC maximize the payoff from time set aside for individual and crew training. They include: (a) tools for predicting live-fire performance (e.g., rifle marksmanship, tank gunnery) from TADSS-based performance, (b) TADSS-oriented strategies to support efficient and effective Abrams Tank and Bradley Fighting Vehicle gunnery training, (c) a software program to enable accurate performance predictions of any live-fire evaluation event that is simulated on a training device, (d) a computer-based program for training maintenance skills when operational equipment is unavailable, (e) information on the beneficial impact of rapid train-up programs for Individual Ready Reserve (IRR) rotary-wing aviators and

field medics, and (f) recommendations about which IRR soldiers should be selected for reducing mobilization training time and costs.

Overcoming Time Constraints – Unit and Battle Staff Training. The products summarized in this chapter are designed to help the RC make the most of available time set aside for unit tactical and battle staff training. They include: (a) specially developed, progressive, simulation-based tables/exercises to support tactical training at the platoon through battalion/task force level, and (b) simulation-based exercises and computer-based courseware to support individual, as well as combined, battle staff member training on techniques that facilitate the flow of information to, from, and between higher, adjacent, subordinate, and supporting headquarters, and (c) findings demonstrating that remotely delivered staff training can be effective and less costly than traditional staff training exercises that require participant travel to a common training site.

Overcoming Dispersion Constraints – Distance Learning and the Electronic Classroom. The products summarized in this chapter are designed to help the RC maintain training effectiveness while reducing travel time requirements for geographically dispersed soldiers/units. They include: (a) a software tool to help training course developers select between synchronous or asynchronous course delivery options for distance learning, (b) recommendations on how to conduct effective and efficient computer-mediated training via asynchronous computer conferencing, (c) a general review of the distance learning literature, (d) a job aid to assist instructors in the conduct of training via different distance learning approaches, (e) guidance for course developers/managers on how to implement computer-mediated training in accordance with the systems approach to training, and (f) results of ARI's research efforts to assist the National Guard Bureau with establishment of a regional network to support instructional delivery via distance learning.

Understanding Attrition. The products summarized in this chapter consist of attitude and opinion survey information gathered to help the RC understand how to best recruit and retain high quality soldiers. They include information on (a) who tends to leave the RC, (b) what military job-related factors are predictive of an Active Component (AC) soldier's decision to transition to, and then remain in, the RC, (c) family dissatisfaction with the RC and recommendations for its amelioration, and (d) how participation in additional training opportunities, such as National Training Center Rotations and Reforger/Blazing Trails Exercises, affect subsequent RC soldier attrition.

What We Know From Deployments. The products summarized in this chapter consist of information on the impact of RC participation in overseas deployments. They include: (a) RC soldier reactions to the Operation Desert Storm Call-up, and (b) a comprehensive look at the results of the first deployment of a composite AC/RC battalion for a 6-month rotational peacekeeping mission in the Sinai Peninsula.

What's the Payoff? This last chapter provides a quick summary of what we think is the payoff associated with the products summarized in the preceding chapters.

Utilization of Findings:

The contents of this catalog provide a summary of selected ARI products that, when used, are likely to enhance the readiness levels of RC soldiers and units. They reveal not only what ARI has done up until now, but also the scope of what it is capable of doing in the future, to support RC R&D products needs of the 21st Century.

A CATALOG OF U.S. ARMY RESEARCH INSTITUTE PRODUCTS DEVELOPED FROM 1985-1998 FOR THE RESERVE COMPONENT

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Chapter 1: Introduction

Purpose

We've written this report to provide the military and behavioral research communities with a catalog of research and development (R&D) products produced by the U.S. Army Research Institute (ARI) on behalf of the Army National Guard (ARNG) and Reserve (USAR) (i.e., the Reserve Component [RC]). These products date from the present to as far back as 1985 and were selected for inclusion because of their potential contribution to future RC readiness.

In most cases, the product summaries cover why, how, and with/for whom work was done, what was found or developed, what the conclusions or implications are, and where more information can be found. By providing these summaries, we hope to reveal not only what ARI has done up until now, but also the scope of what it is capable of doing in the future, to support RC R&D product needs of the 21st Century.

Organization

The report is divided into seven chapters. The first describes ARI and its mission, and then the RC, its organization and strength, and how its operational environment differs from that of the Active Component (AC). The next two describe products that use training aids, devices, simulators, and simulations (TADSS) to overcome RC individual/crew (Chapter 2) and unit/battle staff (Chapter 3) training time constraints. Chapter 4 talks about products designed to bring geographically dispersed soldiers closer together via distance learning. Chapter 5 describes the results of our efforts to understand and predict RC soldier attrition. Chapter 6 tells what we know about the impact of active duty deployment on RC soldiers, and the feasibility of using composite AC/RC units for peacekeeping missions. The final chapter summarizes what we think is the payoff associated with the products described.

ARI and Its Mission

A directorate of the Total Army Personnel Command (PERSCOM), ARI is the Army's lead laboratory and developing agency for personnel performance and training technology. Its work program is performed by a 119 member staff located at 10 research units. Four of which are located at Army Training and Doctrine Command (TRADOC) schools: The Infantry Forces Research Unit at Fort Benning, GA; the Armored Forces Research Unit at Fort Knox, KY; the Rotary-Wing Aviation Research Unit at Fort Rucker, AL; and the Fort Leavenworth Research Unit at Fort Leavenworth, KS. Four are co-located with ARI Headquarters in Alexandria, VA: The Advanced Training Methods

Research Unit; the Selection and Assignment Research Unit; the Organization and Personnel Resources Research Unit; and the Army Trend Analysis Group. The remaining two units are located at special military facilities. The Reserve Component Training Research Unit is located at Gowen Field, Boise, ID, where the RC has its largest training facility. The Simulation Systems Research Unit is located in Orlando, FL, where the Department of Defense conducts a large portion of its simulator-related activities.

ARI's mission is to (a) maximize combat effectiveness through timely research in the accession, training, use, and retention of soldiers, and (b) to support decision making by Army leaders through personnel performance and training research, development, and study and analysis programs (U.S. Army Research Institute FY1997 GPRA Performance Report).

Because this mission extends to the Total Army, ARI provides products of vital importance to both the AC and RC as they seek to better understand, measure, predict, and enhance soldier/unit performance. These products are developed in response to expressed needs of sponsors and proponents, who are the initial beneficiaries. In addition, ARI's support for the Total Army includes technology transfer, technical advisory service, and dissemination of information in documents such as this special report.

The Reserve Component

Historically, most R&D efforts have been driven by needs of the AC under the assumption that what works for the AC will also work for the RC. A closer look at the RC, however, suggests that stark differences exist between it and the AC. Thus, RC-specific R&D products are necessary and more likely to have a greater impact if based on a thorough understanding of the RC and its unique operational environment, as described below.

Mission

The RC consists of the ARNG and USAR. Its federal mission is to provide trained and equipped units and individuals for active duty in time of war, national emergency, and in support of peacetime military operations. The ARNG also supports state missions to protect life and property, and preserve peace, order, and public safety, when called upon by state Governors (Office of the Assistant Secretary of Defense for Reserve Affairs, 1995, February 21).

Strength

There are about 597,000 soldiers in the RC (370,000 ARNG; 227,000 USAR, excluding 318,000 Individual Ready Reserve [IRR]), just over half of Total Army strength (Total Army, 1997, Winter). This number should decrease as projections for FY98 reduce RC end strength to 575,000 funded positions (i.e., 367,000 ARNG; 208,000 USAR) (Research and Staff Support Office of the National Guard Bureau, 1996) with

additional cuts likely if the latest Quadrennial Defense Review (QDR) recommendations are adopted (Cohen, 1997).

Organizational Structure

Under the current organizational structure, ARNG units are predominantly combat and combat support (CS), whereas USAR units are predominantly combat service support (CSS) (National Guard Bureau, 1997). This structure, however, is also likely to change somewhat if QDR recommendations or current force realignment plans of the ARNG Division Redesign Study Group are adopted (An Interview with General Baca, 1997, January; West, 1996, July). A recent article in *On Guard* lays out how these changes are starting to unfold in terms of greater AC/RC integration of combat units (Haskell, 1998).

Active/Reserve Component Differences

The RC operational environment differs considerably from that of the AC. (See Table 1-1 for a quick overview.) This section draws heavily upon work done earlier by the U.S. Army Training Board (1987) to highlight some of these differences.

Table 1-1. Overview of AC/RC Differences.

Variable	*AC*	*RC*
Training Time	Year-round	38/39 days
MOS Mismatch	Minor problem	Major problem
Recruitment	Nearly all nonprior service	Half nonprior service
Retention Incentives	Career benefits, salary, retirement pension	Extra dimension in life, retirement pension
Residence	Most soldiers on post, others nearby	No soldiers on post, many travel long distances
Family/Military Conflict	Moderate for most, though less for senior soldiers	Moderate for junior soldiers; severe for senior soldiers
Military Spouses	Considerable interaction	Little interaction
Employer/Military Conflict	None	Moderate for junior soldiers; severe for senior soldiers
Career Development	Structured and desired; little conflict with personal life	Unstructured and ambiguous; considerable conflict with personal life

Training Time

Perhaps the most obvious difference between the AC and RC is the amount of training time allocated to each. RC units are officially allocated 38 (USAR) and 39 (ARNG) days per year for training purposes. Although individual soldiers and designated units get more time for special events (e.g., New Equipment Training [NET], National Training Center [NTC] rotations), at best (using 240 days as the basis of comparison) RC units have less then one-fifth of the time available to their AC counterparts. At worst (using 365 days as the basis of comparison), RC units have slightly less than one out of every nine days available to AC units.

The RC training year has two parts: Inactive Duty Training (IDT) and Annual Training (AT). IDT time is allocated on the basis of discrete periods called Unit Training Assemblies (UTAs). The typical RC unit is allocated 48 UTAs per year (exceptions include aviation, nuclear, and airborne units that receive more). Whenever two or more UTAs are combined into a continuous training period, the result is called a Multiple Unit Training Assembly (MUTA). A MUTA-4, for instance, is a continuous block of four UTAs. Each UTA must be at least 4 hr long. Thus, at a minimum, 48 UTAs equal 24, 8-hr days.

The official 38/39-day allocation is derived from the combination of these 24 days (one, 2-day weekend per month for IDT) plus 14/15 days of AT. AT consists of 14 continuous days for USAR units and 15 continuous days for ARNG units. AT is almost always conducted during the summer at an RC or AC Major Training Area (MTA). During AT, units are able to assemble at higher levels than during IDT and, depending on their organization, train in a battalion or higher configuration. Few units, however, have their full assigned strength available at AT because some of their soldiers will be training elsewhere (e.g., basic/advanced or career development training) during this same period.

Although 14/15 days are officially allocated for AT, units do not have all of this time available for training. On the average, RC units spend 3 to 4 days of this training time for such things as travel, pick up and turn in of equipment, and administrative set up.

Geographical Dispersion

RC units are also more geographically dispersed (over 4,200 separate armories/reserve centers in over 4,000 separate communities across the U.S. and its territories) than AC units (Office of the Assistant Secretary of Defense for Reserve Affairs, 1995, February 21). RC units (i.e., battalion, company, detachment), for example, travel an average of 105 miles to reach their higher headquarters, whereas comparable AC units are usually within walking distance of each other. At battalion level, the average RC unit is dispersed over a 150-mile radius (some over a 300-mile radius). Their AC counterparts, in contrast, are typically clustered within a mile or less of each other. At higher levels of command (e.g., division), few RC headquarters have all of their subordinate units co-located even in the same state; many extend over several,

and some cover as many as 12 states. Comparable AC units typically live on a single installation or on several installations located within a few hours drive of each other.

The dispersion of RC units is dictated largely by recruiting capacities related to population densities and the ability of soldiers to get to their units for training from reasonable distances. Even so, many travel several hundred miles one way to train during IDT. This level of dispersion, forces RC commanders to expend far more time and effort than their AC counterparts in traveling to and from their units and higher headquarters.

The distance between RC units is only one aspect of dispersion. The distance from a given unit to common training support locations is also lengthened. On the average, RC units travel about 9 miles to get to a motor pool (primarily for wheeled vehicles), and 129 miles to train on their major equipment which is typically located at Mobilization and Training Equipment Sites (MATES). In order to reach a collective training site, they must travel 40 miles to the nearest Local Training Area (LTA) and 154 miles to the nearest MTA. To get to a rifle range, RC units must travel an average of 68 miles (only 20% of RC units have local small-caliber ranges) and if an RC unit wishes to draw devices for training, it must travel 150 miles to do so. These are all average one-way distances and whenever they apply, time is needed to make the trips.

Overall, geographical dispersion makes communication and coordination among RC units more difficult and reduces the frequency with which units can use training facilities and areas. It also increases the level of difficulty in providing support, evaluation, and other services to subordinate units, decreases the ability of next higher headquarters to influence training in person, increases reaction time to change, and requires most training to be conducted at the local armory/reserve center.

Turbulence

Although RC units must train under more severe constraints than their AC counterparts, it is commonly thought that greater stability in the RC is an offsetting plus. While this perception is true in absolute terms, it is false in relative terms. In fact, RC units experience more rather than less relative turbulence than AC units.

Turbulence comes in several forms, the most common form applies to personnel. About 19% of ARNG, and 31% of USAR, enlisted soldiers leave the force each year (i.e., attrition). When one adds those soldiers who leave their units (companies) but stay in the force (i.e., turnover), however, these figures jump to 32% and 44% for the ARNG and USAR, respectively. At the E5 and below level, turbulence (i.e., attrition plus turnover) in units jumps further to 38% and 48% per year.

Unlike in the AC, many soldiers who join an RC unit are not MOS qualified. Between 38% (USAR) and 53% (ARNG) of these soldiers have no military training upon assignment (non-prior service) and a portion of the remainder (prior service) do not have MOS training in the duty positions to which they are assigned. The result is that about

70% (USAR) and 75% (ARNG) of all new enlisted soldiers arriving in a unit each year require training to become qualified in the MOS in which they will be working

In addition to personnel turbulence, RC units are also faced with a significant level of structural turbulence. RC units have historically faced a higher level of structural turbulence than AC units because of functional conversion (e.g. from a tank battalion to a signal battalion). Although such structural turbulence often results in significant soldier retraining (because of MOS mismatches) and initial increases in unit turnover, it is likely to increase as a result of downsizing and anticipated organizational changes in the RC over the coming years.

Family and Civilian Job Conflicts

The AC and RC also differ with respect to the magnitude of family conflict experienced. As reported in a series of reports by Moskos (1990a, 1990b, 1990c), military/family conflict in the RC tends to be more severe at senior levels than at junior levels, whereas the opposite is true in the AC. This is most likely the case because time demands beyond the typical 38/39 days are more pronounced for career reservists, heightening the conflict as a soldier moves up the RC career ladder. Compounding this situation is the need for RC soldiers to work out these conflicts within the family itself without the opportunity to share experiences with other RC members and their families.

Perhaps more significant than military/family conflict, is the conflict experienced by RC soldiers with their civilian employers, with this conflict felt more severely by those with the most demanding civilian jobs. For noncommissioned officers (NCOs), the demands of career development are noted most in the need to take military courses for changes in their MOS and for promotion eligibility. For officers, the demands of career development are most often in the form of resident school training that requires extended absences from the civilian job (and military unit as well). Regardless of NCO or officer rank, the biggest problem for RC soldiers holding a civilian job is finding the time required to "climb the RC ladder." What many reservists find is that their civilian work situation suffers if they take the time to go off to school or devote extra time to their military unit.

Conclusions

Clearly, the RC environment differs in many ways from that of the AC. Because of these differences, the often-made assumption that R&D products developed for the AC will also work for the RC must be called into question. In fact, it's probably safer to assume the reverse in most cases (i.e., that products developed for the RC will also work for the AC).

In any event, ARI has been aware for quite some time now of the real challenges faced by the RC as a result of its unique environment and of the need for RC-specific R&D products to help meet these challenges. The rest of this report describes the results of ARI's efforts to provide these products.

Chapter 2: Overcoming Time Constraints - Individual and Crew Training

In the Summer of 1985, ARI established the Reserve Component Training Research Unit at Gowen Field, Boise, ID, with the mission to develop R&D products tailored specifically to RC needs. One of this unit's first projects, conducted at the request of the National Guard Bureau (NGB) and the Office of the Chief, Army Reserve (OCAR), was to conduct a national mail-out survey of 2,650 ARNG and 1,454 USAR soldiers to find out what training problems they might be having and what solutions they would propose (Eisley & Viner, 1989).

Survey respondents identified training problems associated with geographical dispersion, access to live-fire range/maneuver areas, and family and job conflicts (see Chapter 1). Their overriding concerns, however, were insufficient training time and its nonproductive use when available. NCO respondents estimated, for example, that only 35% of their weekend IDT time was actually spent on training, with the rest spent on other things such as administrative duties and travel to and from LTAs/MTAs. Thus, most respondents agreed that any solution to the problem of insufficient training time must address both how to increase the amount of time available as well as how this time can best be used.

Two solutions suggested by survey respondents were to increase the availability of TADSS for use at home-station armories and reserve centers, and to institute the concept of home study. Eighty-one percent of respondents agreed that TADSS would improve training time usage, and 69% agreed that the home study concept should be explored as a way to increase training time availability. Table 2-1 shows the percentages of soldiers who responded favorably to the home-study concept, their thoughts on what type of media implementation might work, and the conditions under which they might participate.

Table 2-1. Percentage of Soldiers Agreeing with Questions About Home Study.

Survey Item	%
I would work more paid hours if I could study at home (with follow-up testing)	68
I would do home study in addition to regular drill	77
I would do home study in place of regular drill	48
Home study with video cassettes would be effective	87
Home study with computers would be effective	65

Guided in part by the results of this survey, ARI has devoted a sizable portion of its subsequent RC R&D program to providing TADSS-related products that enhance the effectiveness and efficiency of training and increase its accessibility to soldiers/units at their home-stations. Use of TADSS is viewed as having the potential to increase home-station training time productivity by (a) eliminating the travel time normally needed to access operational equipment at LTAs/MTAs, (b) reducing the need for use of costly live-fire ammunition, and (c) promoting better learning opportunities through increased task repetition and variety.

To these ends, ARI's work has focused on the use of TADSS to enhance the payoff of individual, crew, unit, and battle staff training. This chapter describes those products designed to enhance the payoff from individual and crew training, while the next chapter discusses those products designed to enhance the payoff from unit tactical and battle staff synchronization training.

Tools for the Trainer

Rifle Marksmanship Predictor

Constraints on training time and access to live-fire range/maneuver areas confine most weekend IDT to the local, home-station armory or reserve center where it's difficult to provide the kind and amount of realistic training needed to ensure required levels of individual and collective skill proficiency. Even fundamental weapons training suffers because soldiers have limited opportunities to develop and sustain marksmanship skills, engage realistic targets, and practice the kind of tactics needed to succeed on the modern battlefield.

To enable RC units to train to these ends while at home station, several TADSS have been fielded to support the training and evaluation of rifle marksmanship. They include the Weaponeer (Schendel, Heller, Finley, & Hawley, 1985), the Multipurpose Arcade Combat Simulator (MACS) (Schroeder, 1985), and the Engagement Skills Trainer (EST) (Firearms Training Systems, Inc., 1996).

Both Weaponeer and MACS are individual soldier trainers, whereas the EST is a squad-level device capable of supporting the training and evaluation of up to 12 soldiers at a time on rifle marksmanship as well as defensive tactics. EST does this by using a combination of computer-controlled, wide-screen video and laser-hit detection technology where on screen targets are engaged with laser-fitted demilitarized weapons that simulate the recoil and sound of real weapons firing live ammunition (Figure 2-1).

Because of EST's capability to support squad-level training, and the potential payoff in time savings that could be realized from this economy of scale, the ARNG is interested in exploring the use of EST, or EST-like training devices, at home station locations. Thus, data were needed to assess the feasibility of using EST for training purposes, as well as for fulfilling yearly soldier rifle marksmanship qualification

requirements, as already proposed under limited circumstances by the Air Force (Air Force Security Police Agency, 1992).

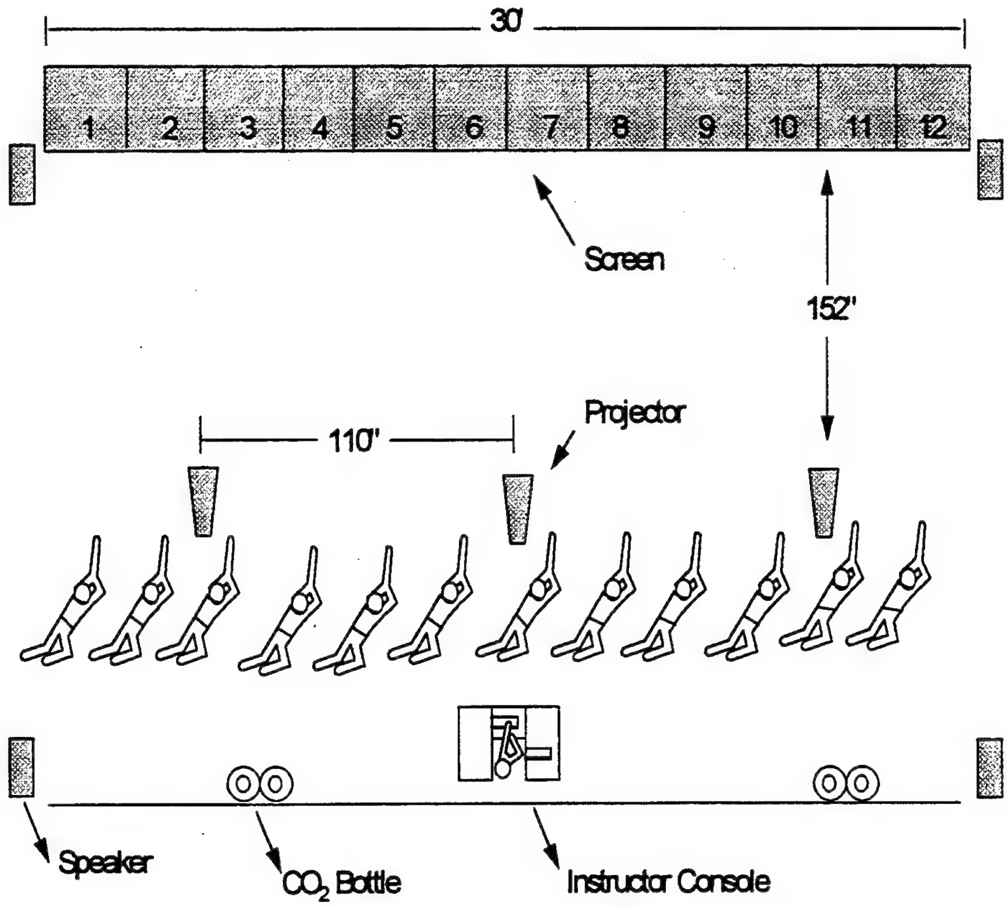

Figure 2-1. Depiction of EST.
From "Using the Engagement Skills Trainer to Predict Rifle Marksmanship Performance," by J. D. Hagman, *Military Psychology*, in publication. Copyright by Lawrence Erlbaum Associates. Reprinted with permission.

While others have shown EST to be an effective device for the *training* of rifle marksmanship (Scholtes & Stapp, 1994) and defensive tactics (Eisley, Hagman, & Ashworth, & Viner, 1990), ARI has been investigating the relation between EST and live-fire performance, and the ability to *predict* the latter from the former. Such predictive capability would not only save time and ammunition, but also reduce current need to use outdoor range facilities for rifle marksmanship evaluation in states where access to such facilities is limited. In addition, knowledge of EST's predictive validity is essential for the making of an informed decision about replacing range-based qualification with EST-based qualification on even a limited basis.

ARI's research objectives were, therefore, to (a) identify the relation between EST- and range-based rifle marksmanship performance, (b) assess how well performance on EST can predict performance on the range, and if the predictive capability is good, then (c) develop an EST-based tool for ARNG company trainers to use in predicting the

range-based rifle marksmanship record fire qualification scores of individual soldiers (Hagman, in publication-a).

Approach

Soldiers from an ARNG mechanized infantry battalion were tested on EST just before firing for record on the range. Simulated record fire on EST replicated the targeting sequence experienced later on the live-fire range. Live fire was conducted on an Army-certified record fire range equipped with pop-up silhouette targets. Record fire scores for specific shooting classifications were as follows: 0-22 Unqualified; 23-29 Marksman; 30-35 Sharpshooter; 36-40 Expert.

Findings

Data analyses revealed that EST scores were good predictors (r = .68) of record fire scores obtained on the live-fire range. (See Figure 2-2 for the scatterplot and best-fit regression line.)

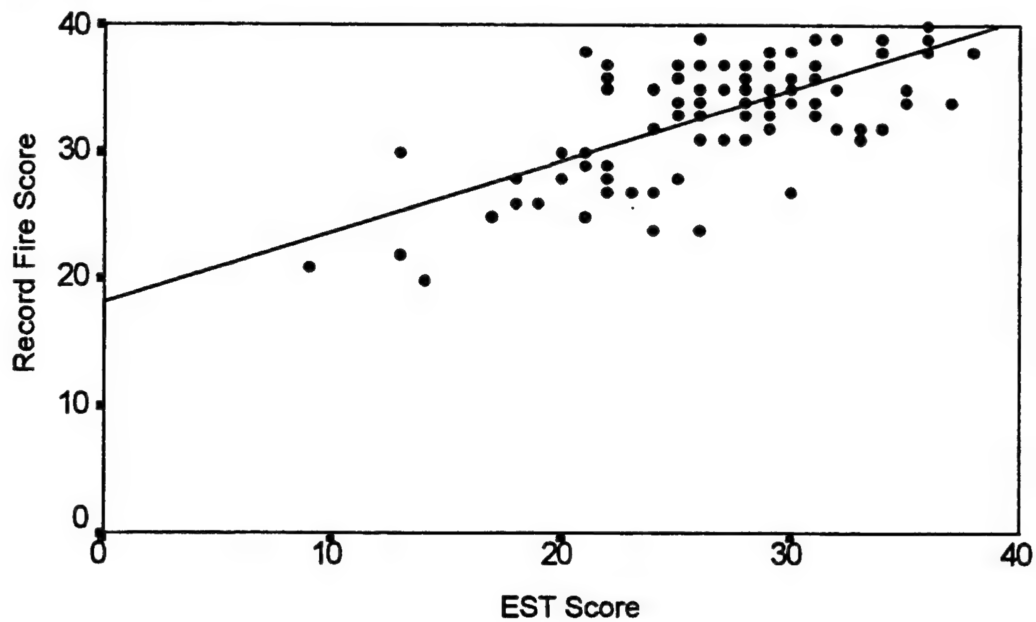

Figure 2-2. Relation between EST and record fire scores.
From "Using the Engagement Skills Trainer to Predict Rifle Marksmanship Performance," by J. D. Hagman, *Military Psychology*, in publication. Copyright by Lawrence Erlbaum Associates. Reprinted with permission.

This relation can support reasonably accurate predictions of record fire qualification scores from EST scores. Table 2-2, for example, shows a selected range of EST scores (Column 1), the associated predicted mean record fire scores (Column 2), and the probabilities of scoring at each of the three qualification levels (Column 3). Using this table, a unit trainer can predict that a soldier with an EST score of 9, for instance, will, on the average, fire a record fire score of 23 and have a 50% chance of successful first-attempt record fire qualification at the Marksman level.

Table 2-2. EST-Based Tool for Predicting the Probability of Firing Record Fire Qualification Ratings of Marksman (≥23), Sharpshooter (≥30), and Expert (≥36).

EST Test Score	Predicted Mean Record Fire Score	Probability (%) of Record Fire Score ≥23	≥30	≥36
1	19	10	--	--
3	20	20	--	--
5	21	30	--	--
7	22	40	--	--
9	23	50	--	--
10	24	60	--	--
12	25	70	--	--
13	26	--	10	--
14	26	80	--	--
16	27	--	20	--
17	27	90	--	--
18	28	--	30	--
20	29		40	--
21	30	--	50	--
23	31	--	60	--
24	32	--	70	10
26	33	--	80	--
27	33	--	--	20
29	34	--	90	30
30	35	--	--	40
32	36	--	--	50
33	37	--	--	60
35	38	--	--	70
37	40	--	--	80

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Conclusions

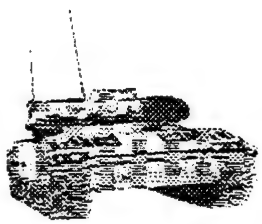
The resulting prediction tool can serve as a diagnostic instrument for helping ARNG commanders and trainers make quick and accurate assessments of the readiness of individual soldiers for record fire qualification before their arrival on the range, thereby maximizing the payoff from each soldier's live-fire experience while conserving live-fire ammunition in the process.

It also provides an empirically derived set of marksmanship performance probabilities for use in determining record fire qualification standards on the device. Such standards, in the form of cutoff scores, would be required should the ARNG or

USAR decide to use EST-based scores in lieu of range-based scores for purposes of yearly qualification. For example, it could be determined that for soldiers to receive a live-fire record fire qualification rating of Marksman (i.e., ≥23) they must shoot an EST score associated with a predicted 80% probability of successful qualification on the range (i.e., 14). Analogous device standards could also be set for the Sharpshooter and Expert levels.

This research provides RC unit trainers with an initial easy-to-use tool for (a) predicting range-based rifle marksmanship performance on the basis of simulated record fire performance on the EST, (b) identifying soldiers in need of remedial training prior to their arrival on the range, and (c) supporting the notion of using EST for purposes of yearly rifle marksmanship qualification firing when access to outdoor range facilities is limited.

Tank Gunnery Predictor



To maximize the payoff from the 39 days available for training each year, ARNG units are looking more and more to use devices for the training of tank gunnery. To ensure successful device usage, a strategy is needed to guide the design and execution of device-based tank gunnery training at the company level where such training typically occurs. Questions that need to be answered include, which device(s) to use, which training and evaluation exercises to conduct, and which proficiency standard(s) to apply, so as to produce device- as well as live-fire proficient crews.

To date, several such strategies have been developed (e.g., Headquarters, TRADOC, 1992; Morrison & Hagman, 1994; U.S Army Armor School [USAARMS], 1993). Although these strategies differ in many respects, each recommends use of the Conduct-of-Fire Trainer (COFT), a stand-alone, high-fidelity device designed for training tank commander and gunner pairs on proper target engagement procedures under fully operational and degraded mode equipment conditions (Campshure, 1991). (See Figure 2-3 for a picture of the mobile version of the COFT.)

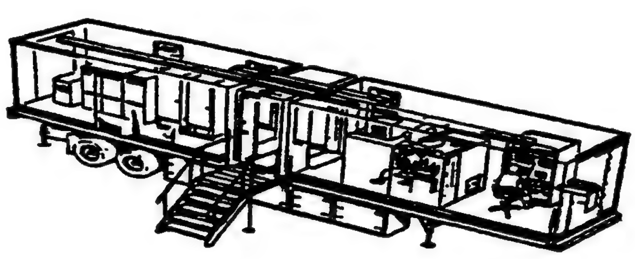


Figure 2-3. Mobile version of the COFT.

In recommending the use of COFT, it is assumed that simulated tank gunnery performance on it is representative, and therefore predictive, of live-fire tank gunnery

performance on the range. Until recently, this predictive relation has received only limited empirical support (Black & Abel, 1987; Butler, Reynolds, Kroh, & Thorne, 1982; Kuma & McConville, 1982). Recent ARI research, however, has successfully identified this relation and, from it, developed a simple tool for RC armor unit trainers to use in predicting live-fire tank gunnery performance on the range from simulated tank gunnery performance on the COFT (Hagman & Smith, 1996).

Approach

To assess this relation, 58 tank crews (i.e., commander and gunner only) from two ARNG armor battalions underwent an hour of COFT testing a day before firing Table VIII (a live-fire exercise fired annually for crew-level gunnery certification) (General Electric Company, 1989). The COFT test consisted of four exercises (131-134) selected from the device's advanced training and evaluation matrix. The scores for these four test exercises, minus points subtracted for procedural errors (i.e., "crew cuts"), were then added and divided by 4 to provide a mean COFT test score for use in predicting Table VIII criterion performance.

Table VIII consisted of 10 live-fire engagements (6 day and 4 night) for which tank crews received a total score of from 0-1,000 points depending on their demonstrated gunnery proficiency. Each crew's goal on Table VIII was to fire at least the minimum qualification score of 700 on the first run down range. These first-run scores were used as the to-be-predicted measure of gunnery proficiency.

Findings

Data analyses revealed that it was possible to predict ($r = .77$) Table VIII scores on the basis of COFT scores. (See Figure 2-4 for the scatterplot and best-fit regression line.) Table 2-3 shows how the predictions work. A unit trainer can use this table to predict that an individual tank crew with a COFT test score of 824, for instance, would, on the average, fire a Table VIII score of 756 and have a 70% chance of successful first-run qualification.

Conclusions

Like the rifle marksmanship tool described in the previous section, the resulting tank gunnery prediction tool enables RC armor unit trainers to make quick and accurate assessments of the readiness of individual tank crews for live-fire gunnery *before* their arrival on the range, thereby maximizing the payoff from each crew's live-fire experience while conserving costly main-gun tank ammunition in the process.

Just how many Table VIII main-gun rounds could be saved each year through use of the prediction tool can be determined by plotting the estimated number of main-gun rounds fired yearly by the ARNG (maximum of 2,561 armor crews at the time of calculation) on Table VIII against the predicted probability of first-run qualification. As

shown in Figure 2-5, this relation reveals that somewhere in the neighborhood of 1,640 fewer main-gun rounds would be fired on Table VIII for each predicted 10% increase in first-run crew qualification. Table 2-4 shows the specific data used to derive this relation.

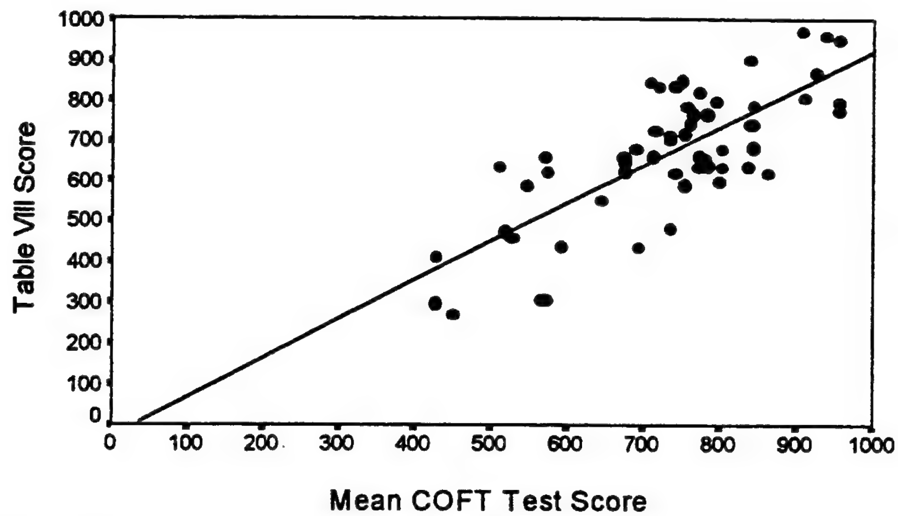


Figure 2-4. Relation between COFT and Table VIII scores.
From "Device-Based Prediction of Tank Gunnery Performance," by J. D. Hagman and M. D. Smith, *Military Psychology, 8,* 59-68. Copyright 1996 by Lawrence Erlbaum Associates. Reprinted with permission.

Table 2-3. COFT-Based Tool for Predicting a Tank Crew's Chances of First-Run Table VIII Qualification.

Mean COFT Test Score	*Predicted Mean Table VIII Score*	*Probability of Firing ≥700 on Table VIII*
620	562	10%
669	609	20%
706	644	30%
737	673	40%
765	700	50%
793	727	60%
824	756	70%
861	791	80%
910	838	90%

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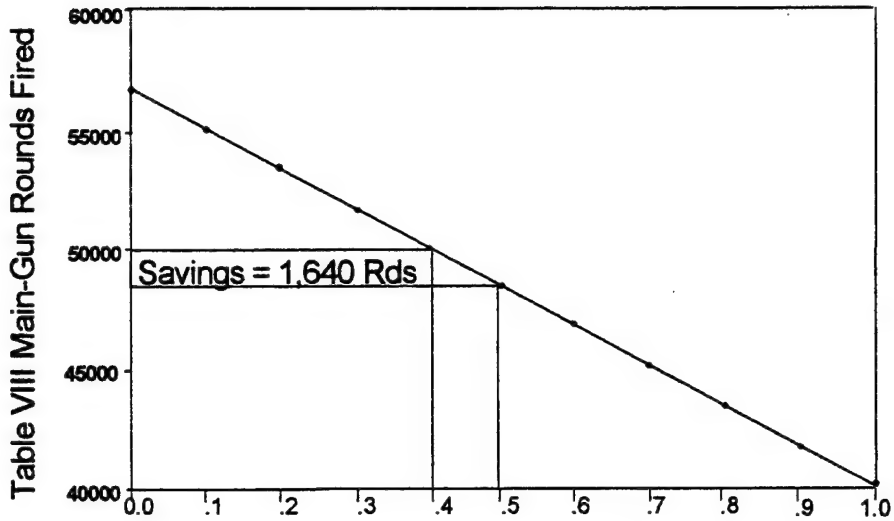


Figure 2-5. Expected ARNG-wide main gun tank ammunition savings for each 10% increase in 1st-run Table VIII qualification.

Table 2-4. Data Used to Derive Main Gun Round Savings Estimates[a]

Probability of 1st-Run Qualification	*# of Crews Q1*	*# of Crews Q2+*	*# Rds Fired Q1[a]*	*# Rds Fired Q2+*	*Total Rds Fired*
.00	0	2561	0	56598	56598
.10	256	2305	4019	50940	54959
.20	512	2049	8038	45283	53321
.30	768	1793	12057	39625	51682
.40	1024	1537	16077	33968	50063
.50	1280	1281	20096	28310	48406
.60	1536	1025	24115	22653	46768
.70	1792	769	28134	16995	45129
.80	2048	513	32154	11337	43491
.90	2304	257	36173	5679	41852
1.00	2561	0	0208	0	40208

[a]Estimated number of rounds fired was based on the results of an analysis of 1994/1995 Table VIII scores for 112 ARNG tank crews (34 first-run qualified [Q1] and 78 second- or later-run qualified [Q2+]) where it was found that Q1 and Q2+ crews fired an average of 15.7 and 22.1 main-gun rounds, respectively.

The prediction tool also provides researchers with an empirically derived set of performance standards for incorporation into future gunnery training strategies that until now have relied on speculation to estimate the level of device-based gunnery proficiency needed to ensure a crew's successful first-run Table VIII qualification.

By-product

As a follow up to the above prediction tool work with rifle marksmanship and tank gunnery, ARI has developed a floppy-disc-based software program that enables RC unit trainers to develop their own prediction tools tailored to the specific device(s) and live-fire range(s) used for training and evaluation (Hagman, in publication-b). The tool is generic in nature in that it can be used whenever a live-fire evaluation event (e.g., Tank Table VIII) is simulated on a training device (e.g., COFT), and the scoring procedure is the same for each.

Once the required device/live-fire scores are collected and then entered into the program by the user (See Figure 2-6 for a picture of the data entry screen.), a click of the mouse provides predictions in tabular format similar to that shown in Tables 2-2 and 2-3. The actions required for creating, viewing, interpreting, and using the resulting predictions are listed in menu format (see Figure 2-7), with context-sensitive, on-line user help provided each step of the way. A copy of the program can be obtained via e-mail request to the first author at jhagman2@bsumail.idbsu.edu. In addition, the interested reader can check the ARI Internet Home Page at www-ari.army.mil for updated information.

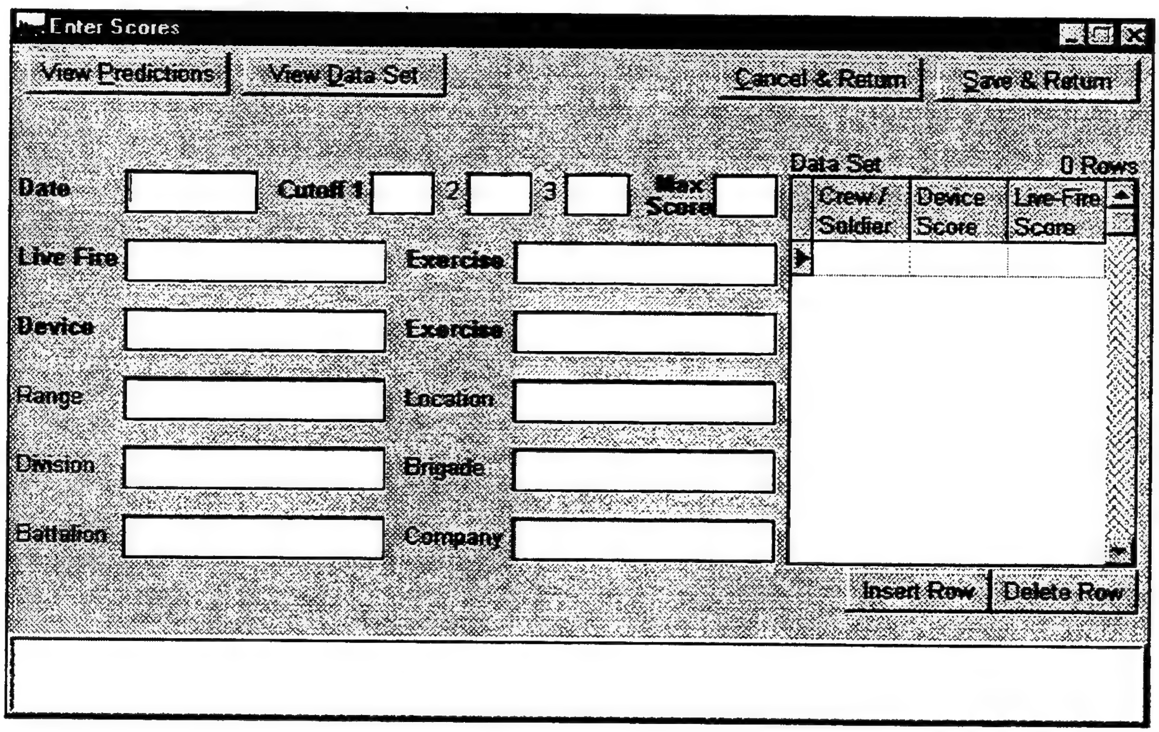


Figure 2-6. Data entry screen for prediction tool program.

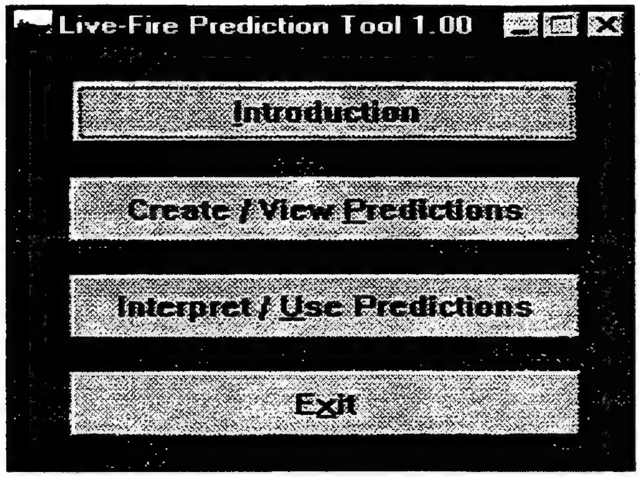
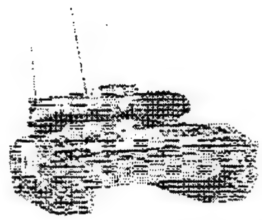


Figure 2-7. Main menu of prediction tool program

A Device-Based Tank Gunnery Training Strategy



Development of the COFT-based prediction tool has enabled ARI to develop a device-oriented, proficiency-based tank gunnery training strategy for the ARNG. This strategy maximizes the efficiency of training device usage, provides specific guidance to support standardized implementation at the company level, and promotes successful transition from device- to tank-based training and associated live-fire gunnery qualification on Table VIII (Hagman & Morrison, 1996).

In general, the strategy shows ARNG armor unit trainers how to complete the device-based portion of their tank gunnery training programs in just 3 IDT weekends, and afterwards be able to predict how many, and which, crews will be first-run qualifiers. In addition, the strategy eliminates any guesswork in determining the crews to be trained, the TADSS to use, and the training and evaluation exercises to conduct for maximizing the payoff from the training time invested.

Pretesting

The strategy, as shown in Figure 2-8, begins with an hour pretest on the COFT to determine the gunnery proficiency level of each crew. Pretesting calls for the firing of COFT advanced matrix exercises 131-134 used to develop the COFT prediction tool, deriving a total pretest score, and determining the probability of actual first-run qualification based on the prediction table shown in Table 2-3.

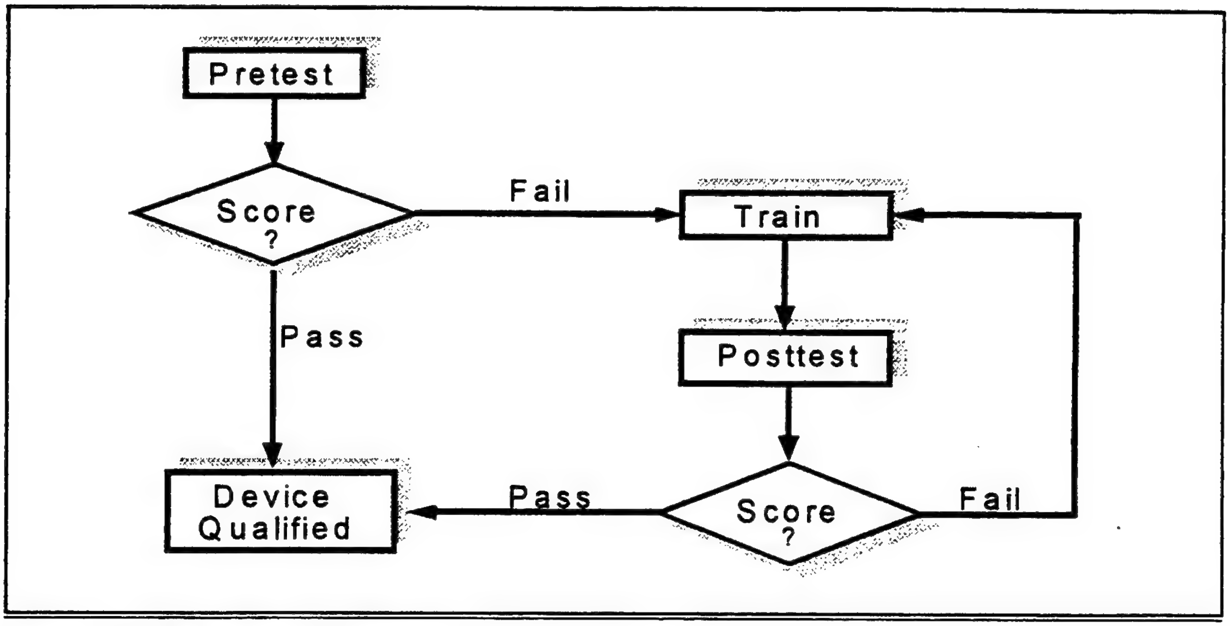


Figure 2-8. Flowchart of strategy.
From "Research Pays Off for the Guard: A Device-Based Strategy for Training Tank Gunnery" by J. D. Hagman and J. E. Morrison, *Armor, 6,* 48-50.

Depending on the standard set by the commander for his unit's first-run Table VIII qualification rate (selected from Table 2-3, Column 3), some crews will pass the pretest (device-qualified crews) while others will not (device-unqualified crews). According to the strategy, only the latter must undergo device-based training. Thus, valuable time is not taken up training crews that are already device proficient.

Training

After identifying which crews need to be trained (and which ones don't), the next step is to determine which training device(s) to use and which training exercises to conduct. According to the strategy, training can be conducted on either COFT or the Abrams Full-Crew Interactive Simulation Trainer (AFIST), a tank-appended full-crew tank gunnery training device (Snyder, 1996) (Figure 2-9). This training should focus on only the simulated Table VIII engagements not performed to pretest standard. This standard is determined by dividing the pretest score (e.g., 765) by 10 (the number of engagements fired per exercise). Any engagements not fired to this standard (e.g., 76.5) must be trained. Table 2-5 shows the training exercises on each device that correspond to each Table VIII engagement.

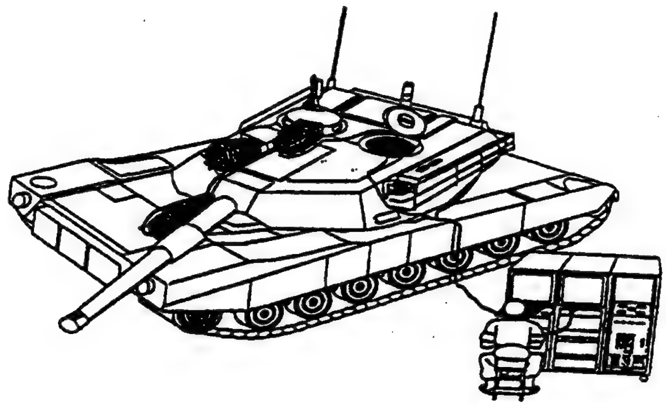


Figure 2-9. AFIST appended to M1 tank.

Table 2-5. COFT and AFIST Training Exercises for Table VIII Engagements.

Table VIII Engagements	COFT Training Exercises	AFIST Training Exercises
A1	113, 117	6T1
A2	101, 111	--
A3	102, 106	6AT2
A4	102, 106, 110	6AT3
A5S	102, 106, 110	6AT4
A5A	102, 106, 110	6AT5
B1S	103, 107, 119	6BT1
B2	105	6BT2
B3	110	6BT3
B4	102, 106, 110	6BT4
B5	113, 117	6AT1
B5A	105	6BT5

From "Research Pays Off for the Guard: A Device-Based Strategy for Training Tank Gunnery" by J. D. Hagman and J. E. Morrison, *Armor, 6,* 48-50.

Except for on Engagement A2, the simultaneous engagement that requires use of the Caliber .50 machine gun not simulated by AFIST, it is recommended that AFIST be used whenever possible because of its capability to support full-crew (commander, gunner, loader, and criver) training. Furthermore, if AFIST is not available, training should alternate between or among the training exercises shown in Table 2-5 for the COFT to add the kind of variety needed to promote device-to-tank transfer (Wells & Hagman, 1989).

Regardless of which device is used, an easy-to-difficult progression should be followed when pretesting reveals that some crews need training on more than one

simulated Table VIII engagement. Table 2-6 shows the difficulty rankings found for live-fire Table VIII engagements (Hagman, 1994). Engagement B5 should be trained before B2, A1 before A3, and so forth.

Table 2-6. Difficulty Rankings for Table VIII Engagements.

	Engagement											
	A3 Most	B3	A2	A1	B2	A4	B4	B5	A5S	A5A	B5A	B1S Least
Difficulty Ranking	1	2	3	4	5	6.5	6.5	8	9	10	11	12

From "Research Pays Off for the Guard: A Device-Based Strategy for Training Tank Gunnery" by J. D. Hagman and J. E. Morrison, *Armor, 6,* 48-50.

To ensure that tank crews become device proficient and, at the same time, do not pass a training exercise by luck, the strategy recommends that the proficiency standard for training exercises be set at two successful, but not necessarily consecutive, criterion performances. On COFT, criterion performance is reached upon crew receipt of an "advance" recommendation from the device in the areas of target acquisition, reticle aim, and system management. On AFIST, criterion performance is reached upon crew receipt of a "pass" recommendation from the device for the exercise(s) being trained.

Posttesting

Just because a crew passes the training exercises, it is not necessarily device qualified. So the last step in the strategy is to posttest crews by having them retake the pretest. Those that pass the posttest are considered device qualified; those that fail the posttest must return for further training on devices as outlined above.

Implementation Considerations

The above strategy is designed for unit implementation over three (preferably consecutive) IDT drill weekends once pretesting is completed. It is anticipated that the hour or so needed for pretesting would be included as part of the Tank Crew Gunnery Skills Test, with Readiness Management Assemblies used if drill time runs out.

Before the first scheduled drill after pretesting, pretest scores should be compared against the performance standard for first-run Table VIII qualification set by the unit commander (see Table 2-3, Column 3). This allows for a determination of which crews are device-unqualified and which engagements they need to fire during training. Similarly, the training results of this and the next two drills should be reviewed to select the right training exercises for those crews not ready for posttesting and to posttest those that have completed training.

Once all crews are device qualified, by virtue of passing either the pre- or posttest, on-tank training should begin, probably with Table V (e.g., Department of the Army,

1993) or with Combat Table I (U.S. Army Armor Center [USAARMC], 1995). Regardless of where on-tank training begins, time on the tank is necessary because it allows crews to experience the different aspects of gunnery not practiced or simulated on devices (e.g., open-hatch target acquisition, tank movement, and weapon recoil effects) but important for successful Table VIII qualification.

Conclusions

The above strategy allows ARNG armor unit trainers to do several things now that they could not do before. First, they can schedule device-based training time more efficiently by targeting only crews in need of remediation. They can also identify which exercises to conduct when training is called for. And lastly, because device performance standards are keyed to expected live-fire outcomes, trainers can determine when their crews have received enough device-based training to warrant transition to the tank, and what the expected result will be in terms of their unit's first-run Table VIII qualification rate. After all, tank gunnery training on devices takes time. Although this time is scarce, the strategy just described provides the tools needed to use it wisely.

A Time-Compressed Gunnery Training Strategy

In addition to developing the above proficiency-based strategy for training tank gunnery on devices, ARI has recently completed assessment of an alternative TADSS-oriented gunnery training strategy proposed by Project SIMITAR (Simulation in Training for Advanced readiness) for ARNG armored and mechanized infantry units (Smith, 1998a). Project SIMITAR was a direct outgrowth of the perceived need to ensure that TADSS are used effectively and efficienty to meet current ARNG training readiness requirements. Established by Congress in 1992 as a Defense Advanced Research Projects Agency effort, SIMITAR's goal has been to use TADSS to achieve "an order-of-magnitude increase in the training readiness of ARNG combat brigades" (Krug & Pickell, 1996, February).

The proposed SIMITAR strategy uses TADSS (e.g., AFIST, COFT) to augment and, in certain instances, replace the use of operational equipment (e.g., Abrams Tanks, Bradley Fighting Vehicles [BFVs]). The purpose of which is to enable ARNG armored and mechanized infantry units to meet the AT goals of crew-level gunnery qualification on Table VIII and platoon-level gunnery qualification on Table XII, all within the normal 39-day training calender year.

Approach

ARI collected various gunnery measures from an enhanced ARNG armor "test" brigade both before (1993-1994) and after (1995-1997) its implementaiton of the SIMITAR strategy. Similar measures were also collected in six ARNG enhanced "comparison" armored and mechanized infantry brigades that did not train under the SIMITAR strategy.

Findings

Crew-level tank gunnery qualification rates on Tank Table VIII did not differ between test and comparison units, or within the test unit itself, across data collection years (Table 2-7), whereas the associated BFV Table VIII qualification rates tended to favor the comparison units. More importantly, however, the SIMITAR strategy permitted most (94%) fully staffed SIMITAR platoons to complete gunnery Table XII (with an achieved 45% overall qualification rate) without the need for either more training time or live-fire ammunition.

Table 2-7. Tank Table VIII Qualification Percentages for SIMITAR Test and Comparison Brigades.

	Test Brigade		Comparison Brigades	
Time Period	% Qualification [a]	*n*	% Qualification [a]	*n*
Pre-SIMITAR (1993-1994)	96.0	126	90.6	160
SIMITAR Years (1995-1997)	94.3	230	92.8	540

[a] % Qn = proportion of crews eventually achieving Table VIII qualification, e.g., 121 test crews in the pre-SIMITAR period (96.0% of 126 crews) eventually qualified.

Conclusions

The findings of ARI's assessment suggest that emphasized use of TADSS to support tank and BFV gunnery training, as proposed under the SIMITAR strategy, can successfully enable ARNG armored and mechanized infantry units to accomplish crew- and platoon-level gunnery objectives within the usual yearly allocations of training time and ammunition. Normally, the RC training year ends with Table VIII qualification during AT. The SIMITAR strategy, however, allows implementing units to accomplish more at no additional cost.

By-product

As part of the SIMITAR strategy assessment process, ARI has also developed a gunnery database to support longitudinal tracking of live-fire performance measures and related information necessary for assessing the impact of the SIMITAR strategy, as well as other future gunnery training strategies adopted by ARNG armored and mechanized infantry units (Smith, 1998b). The database contains over 100 gunnery-related categories of information collected from seven ARNG armored and mechanized infantry enhanced brigades used to assess the impact of the SIMITAR strategy. Data are structured

according to year, brigade, battalion, company, and crew, with those for earlier years appearing first. The database currently contains data from 1993-1997, but can be expanded to include additional information depending on user needs.

A Model Program for Maintenance Training

Maintenance training at the organizational and direct support (DS)/general support (GS) levels is a nagging problem for the RC because of limited access to operational equipment (e.g., tanks) at the local armory, reserve center, or LTA. When this equipment *is* available, it's normally used for purposes other than maintenance training (e.g., gunnery or maneuver training). Also, because most maintenance is performed by RC full-timers (e.g., technicians) at MATES facilities, mobilization-day (M-day) mechanics often don't get full responsibility for maintenance until their unit is mobilized or under special assignment (e.g., an NTC rotation).

The problem worsens when new, often more sophisticated, equipment is fielded. It is then that trainers, training support materials, and even the equipment itself are often not available in sufficient quantities to accommodate needs of geographical dispersed mechanics. This combination of circumstances occurred with the introduction of the M1 tank to the ARNG. At that time, it was clear that something other than business as usual had to be done to help RC mechanics maintain their tank maintenance skills while at home station even when their new tanks were not readily available.

In response to this need, ARI, in conjunction with Training and Doctrine Command's (TRADOC's) Training Technology Agency, developed a computer-based (self-study) Model Training Program for RC Units (MTP-RC). This program was designed to train/sustain M1 mechanics on tank troubleshooting and maintenance skills in the absence of actual equipment.

Courseware

About 40 hrs of self-paced, computer-based instructional (CBI) courseware were developed and targeted for four MOSs: two at the organizational maintenance level (45E--M1 Abrams Tank Turret Mechanic; 63E--M1 Abrams Tank Systems Mechanic); two at the DS/GS levels (45K--Tank Turret Repairer; 63H--Track Vehicle Repairer) (Marco, Israelite, & Gunderson, 1986).

Courses began with an introductory lesson followed by lessons on the operation and troubleshooting of different tank systems (e.g., turret, laser rangefinder). Troubleshooting lessons provided a symptom (malfunction), an explanation of what components might be causing the symptom, a guided demonstration on how to troubleshoot these components, and two practical exercises involving different faults. While navigating through the courseware at their own pace, "students" were required to

select/read the appropriate technical manual(s) and communicate with the computer via lightpen.

Approach

After a successful series of formative evaluations with AC soldiers at the Ordnance and Armor Schools (Graham, Shlechter, & Goldberg, 1986), ARI examined MTP-RC program effectiveness in RC units over a 1-year period. Thirty-five soldiers from three RC units were given hands-on and paper-and-pencil pretests followed by corresponding posttests a year later.

Findings

Hands-on Testing. The MTP-RC training program was very effective, as shown by the hands-on test results in Figure 2-10 (Graham, 1987). Even though program participants had no access to their M1 tanks during the training period, their hands-on task performance showed marked improvement from pre- to posttesting.

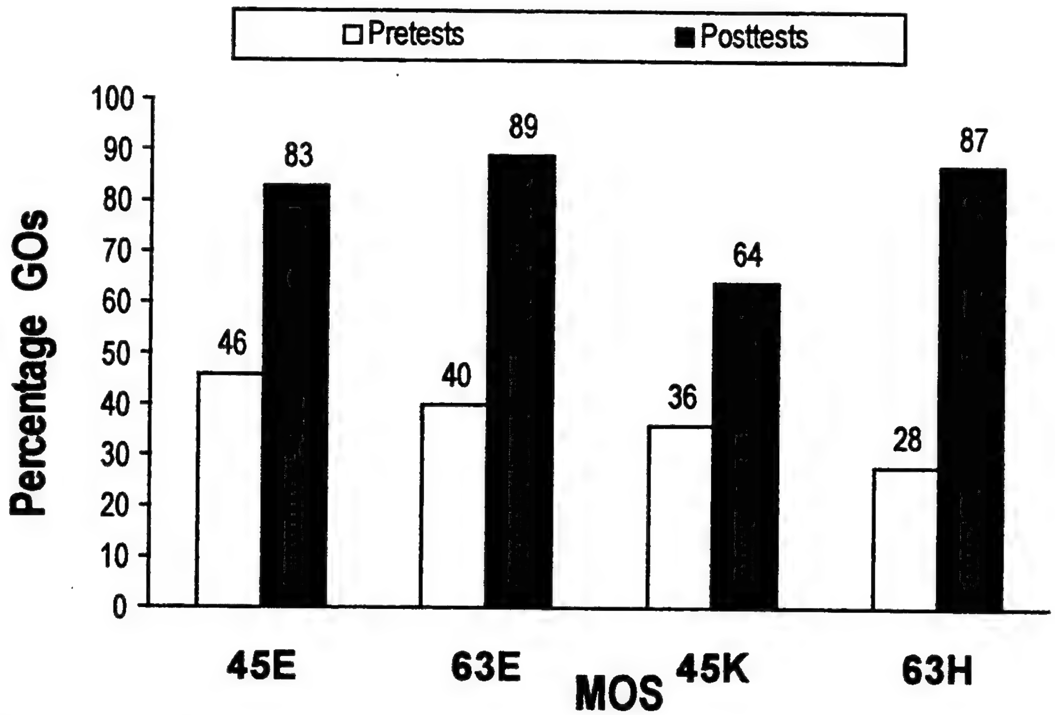


Figure 2-10. Hands-On pretest and posttest results for four MOSs.

These benefits did not vary as a function of maintenance experience. About half of the soldiers with organizational MOSs (45E and 63E) who participated in all phases of the MTP-RC training program also had full-time jobs as MATES technicians. As shown in Table 2-8, these MATES mechanics had much higher hands-on scores than those of the non-MATES mechanics on the pretest but not on the posttest.

Table 2-8. GO Rates of 45E and 63E Soldiers by MATES Employment		
Employment	***Hands-on Pretest***	***Hands-on Posttest***
MATES Employees (n=8)	62%	85%
Non-MATES Employees (n=7)	19%	88%

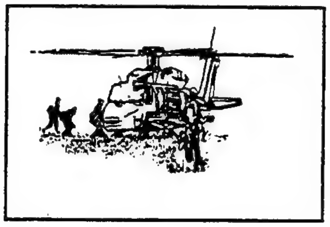
Paper and Pencil Testing. Paper-and-pencil tested job knowledge of the above sample of RC mechanics was also compared with that of recent Advance Individual Training (AIT) graduates who had received resident Armor School training on M1 tank maintenance. Pre- and posttest performance of the organizational-level RC mechanics (45E and 63E MOSs), who had tanks in their units and frequently maintained them, did not differ from that of the AIT graduates. The RC DS/GS-level mechanics (45K and 63H MOSs), who did not have contact with M1 tanks, scored significantly lower than the AIT graduates on the pretest taken before MTP-RC training. At the posttest taken after training, however, this gap had been significantly reduced.

Conclusions

The findings of ARI's assessment revealed that MTP-RC improved the troubleshooting performance of RC mechanics at both organizational and DS/GS levels. As suggested by Graham (1987), success was achieved because a real need for technical skills training existed in the units selected (i.e., there was room for improvement as demonstrated by low pretest scores), and fundamental troubleshooting skills were emphasized (i.e., following technical manuals and executing exact procedures).

Even though the M1-tank courseware developed under MTP-RC is now somewhat outdated because of recent RC tank modernization efforts, the results of the program's assessment provide some valuable lessons to be learned. First, a self-study, CBI approach to the RC training of maintenance-related troubleshooting skills without equipment can serve as an effective substitute for the training of such skills with equipment. Second, just being able to understand and follow steps prescribed in technical manuals is a giant step toward sustaining maintenance proficiency, even when access to operational equipment is limited. . Third, a CBI approach to maintenance training can be implemented at home station. The result of which will be more productive use of time through elimination of travel to and from an operational equipment site (e.g., MATES). And lastly, a CBI approach to the learning of troubleshooting procedures can be efficient because test equipment and components can be connected and removed with the stroke of a lightpen. Thus, given a fixed amount of training time, greater task variety and more task repetitions can be accomplished under a CBI format. Both of which promote skill learning, retention, and transfer (Wells & Hagman, 1989).

How and Whom to Train in the Individual Ready Reserve



Individuals who join the Army incur an 8-year initial service obligation. Most are placed on active duty at the start of this period to be trained in an MOS. Once training is over, these individuals may remain on active duty or complete their service obligation through participation in the ARNG or USAR, as members of Troop Program Units (TPUs) or IRR.

Those who choose the IRR must maintain contact (by telephone or written correspondence) with their military career managers and accumulate points toward fulfilling their military obligation, or toward retirement, by participating in various training programs offered at times convenient to both the Army and the reservist. These training programs enable the Army to maintain (and potentially mobilize) significant numbers of qualified individuals. About 20,000 IRR members were activated, for instance, during the Persian Gulf War (Wisher, Sabol, Maisano, Knott, Curnow, & Ellis, 1996).

To maximize the payoff from these periodically offered IRR training programs, the Army needs to know how to improve their effectiveness while reducing their cost (in time and money). As a result, better answers to the questions of how and with whom to best conduct these programs are continually being sought. At the request of the Assistant Deputy Chief of Staff for Personnel, ARI collected data in the early and mid '80s on IRR rotary-wing aviators and, just recently, on field medics to help the Army answer these questions.

Rotary-Wing Aviators

In 1979, about 6,000 IRR officers were formerly qualified as Army rotary-wing aviators. The retraining programs required to maintain this pool, however, were resource intensive and lacked standardization. To improve this situation, ARI developed a 2-year (consecutive) retraining program for UH-1 Helicopter pilots that included 19 days of both academic and hands-on flight segments conducted on site at the Army Aviation Center at Fort Rucker, Alabama. Although this program was better than previous versions (Allnutt & Everhart, 1980), instructor pilots still thought that too much of their time was being spent on the academic segment. As a result, ARI revised the program to include voluntary/optional home study of the academic segment to be completed prior to aviator arrival at the training site (Wick, Millard, & Cross, 1986). ARI then conducted a 2-year evaluation of this revised program.

Approach

Forty-seven IRR aviators participated in the evaluation during Year 1; 24 of who also participated during Year 2. Upon arriving at the training site, each IRR aviator completed a paper-and-pencil proficiency examination on the topics covered in the home

study materials and underwent additional training on the topics not passed with a 90% correct score.

After successfully completing the academic segment of the program, the trainees proceeded to the in-flight segment. This segment covered basic helicopter flying tasks performed under visual meteorological conditions (Phase 1) and selected tactical/special mission tasks (Phase 2). Exactly which tasks were trained in-flight depended upon the results of a proficiency flight evaluation conducted before the start of the in-flight segment.

In-flight training for each phase ended with a proficiency evaluation checkride conducted by an instructor pilot. Training continued until all trainees passed the checkride or until the 19-day training period was over. The above procedures were followed during both years of the evaluation.

Findings

Academic Performance. All aviators passed the academic segment during the first year of the training program and spent an average of 6.5 days doing so, with those who did more home study showing faster completion times than those who did less. Forty-five of the 47 aviators also passed the academic segment during the second year of the program and spent an average of only 4.3 days doing so. This decrease in completion time from one year to the next was attributed to aviators finishing more home study lessons in preparation for on-site training conducted the second year compared to the first.

Flight Performance. On Year 1, none of the 47 aviators passed the preflight proficiency exam administered prior to Phase 1 training, but all went on to pass the in-flight segment after training. On Year 2, no one also passed the preflight proficiency exam but 22 of 24 successfully completed the in-flight segment after training. An obtained drop in average in-flight segment completion times from 16.2 to 13.8 days for Years 1 and 2, respectively, was attributed partly to an increase observed in the scores achieved on the preflight proficiency exam, and partly to the elimination of the task "Perform Simulated Anti-Torque Malfunction" during Year 2 training.

Predicting Success. Although most aviators can be expected to reacquire flying skills in less time than that required to learn them initially, some will relearn faster than others. The question is which ones will relearn the fastest, and thereby make the most out of the training time available. To answer this question, Wick et al. (1986) examined the extent to which the number of flight hours required to complete flight training (FLTTRAINHRS) could be predicted from (a) the number of flight hours logged during an aviator's active duty military career (MILFLHRS) and (b) the number of years since an aviator had flown on active duty (YEARSOUT). The obtained relation (Figure 2-11) found for Phase 1 of Year 1, for example, revealed that in-flight training hours *increased* with the number of years away from active duty and *decreased* with the number of flight hours logged during active duty.

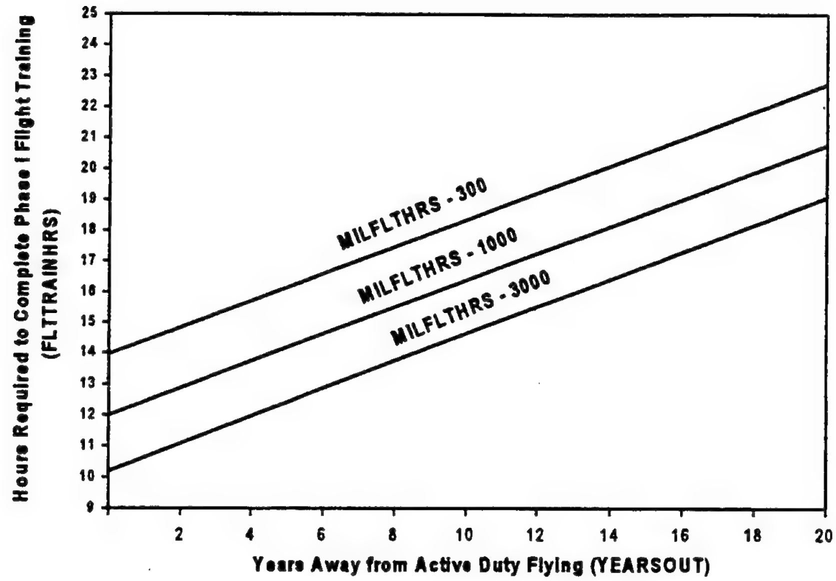


Figure 2-11. Relation between FLTTRAINHRS and YEARSOUT for three levels of MILFLTHRS (Phase 1).

Conclusions

The results of this research revealed that (a) ARI's revised IRR aviator training program was successful in producing a proficient aviator in far less time than that required to do so through the initial entry rotary wing program (which at the time the research was conducted took about 200 hr of classroom academic study and 75 hr of in-flight training), and (b) implementation of an at-home, self-study approach for the purpose of reducing academic material learning time at the training station is a good idea for IRR aviators. The results also suggest that (c) it would be beneficial for mobilization planners to consider the extent of IRR aviators' flight experience while on active duty, as well as their length of time since separation from active duty, when deciding who should be called up in the event of mobilization. Those aviators having only a short separation from active duty, or who flew in the active Army for many years, for example, should require less training time (and cost) to regain proficiency.

Field Medics

Recent ARI research with IRR field medics (Wisher, et al., 1996) has attempted to identify additional predictors of retraining success, as well as assess the generalizability of predictors found earlier to be valid for IRR aviators (Wick, et al., 1986). The utility of four predictors was examined: prior active duty time, time separated from active duty (i.e., retention interval), general aptitude (as measured by Armed Forces Qualification Test [AFQT] scores), and similarity of civilian occupation.

Approach

A total of 114 IRR field medics who had volunteered to participate in a 2-week mobilization exercise (CALL FORWARD 93) participated in the research. All took a job knowledge test and a series of hands-on diagnostic tests to assess their proficiency on 20-selected medical tasks both before classroom training began (pretests) and after it was over (posttests). Training included lectures, total class and small group practical demonstrations (often with training aids such as mannequins or artificial limbs), and individual hands-on testing.

Findings

Retraining. Job knowledge and hands-on performance improved with retraining. Job knowledge scores improved 11% for full-tour soldiers (19 months or more of prior active duty) and 8% for partial-tour soldiers (less than 19 months of prior active duty). In addition, overall hands-on performance improved from a 36% GO rate before retraining to a 92% GO rate after retraining. Compared to the 58 hrs required to train a field medic from scratch, retraining took only 22 hrs to complete (a 63% timesavings).

Predicting Success. The results of data analyses used to identify predictors of retention and reacquisition are shown in Table 2-9. For full-tour medics, separation time from active duty (i.e., retention interval) had no effect on retention, whereas general aptitude, time in active duty, and civilian job similarity/content predicted the forgetting of job knowledge as measured on the pretest. Aptitude predicted job knowledge on the posttest (reacquisition), and nothing predicted hands-on performance on the posttest. For partial-tour medics, the pattern of predictors was somewhat different. Here, both separation time and length of active duty had no predictive value. General aptitude predicted knowledge and hands-on pretest performance, but not knowledge posttest performance, and civilian job predicted performance on all three indices.

The results of additional analyses, conducted separately on full- and partial-tour medics, to assess the relation between civilian job/separation (retention) interval and hands-on performance are shown in Figures 2-12 and 13 for three groups of medical tasks: recording of vital signs (e.g., blood pressure), emergency tasks (e.g., applying a tourniquet), and delayable, poststabilization tasks (e.g., splinting broken limbs). The dotted segments of the lines represent the difference between 100% performance that might be assumed for an active duty field medic. In both figures, the performance (averaged across separation intervals) of IRR medics with a similar civilian job (labeled civilian medics in the figures) on each task is better than that of most recently separated IRR medics. Also separation interval made no difference in the retention performance of full-tour medics. Although it appears to have an adverse impact for partial-tour medics, this drop was not statistically significant for hands-on performance. Subsequent analysis of job knowledge test performance did reveal, however, that partial-tour medics were adversely affected by their length of active duty separation.

Table 2-9. Significant Performance Predictors		
Full-Tour Soldiers: Predicted Measure		
Knowledge Pretest (mean=74%)	Knowledge Posttest (mean=82%)	Hands-on Pretest (mean=42%)
Aptitude p<.001	Aptitude p<.01	No significant predictors
Civilian Job p<.01		
Active Duty p<.05		
Partial-Tour Soldiers: Predicted Measure		
Knowledge Pre-test (mean=67%)	Knowledge Post-test (mean=78%)	Hands-on Pre-test (mean=30%)
Aptitude p<.005		Aptitude p<.025
Civilian Job p<.001	Civilian Job p<.01	Civilian Job p<.0001

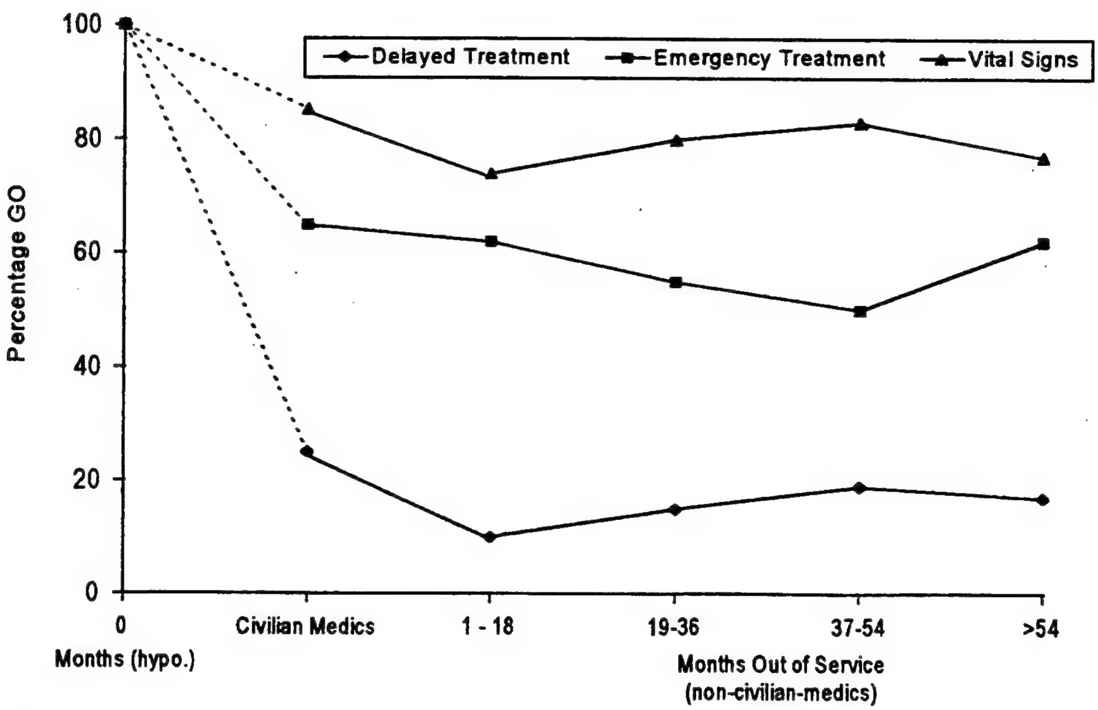


Figure 2-12. Performance on three categories of hands-on tasks as a function of active duty separation interval for full-tour soldiers.

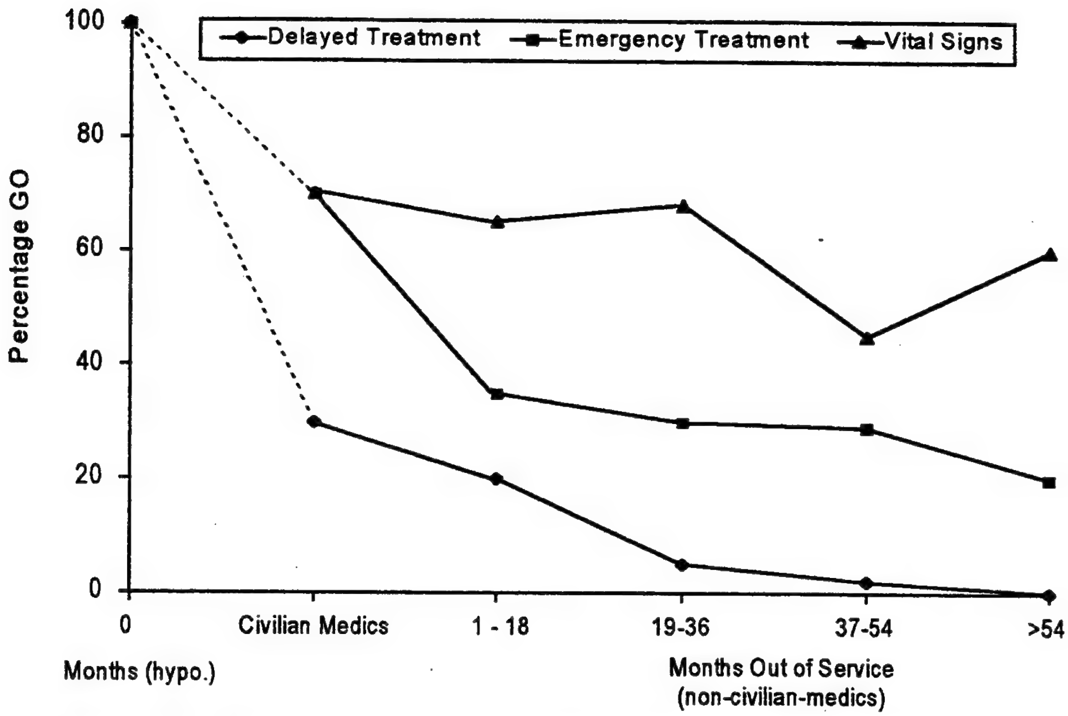


Figure 2-13. Performance on three categories of hands-on tasks as a function of active duty separation interval for partial-tour soldiers.

Conclusions

The findings of this research support the notion of extending the separation interval for IRR field medics during a mobilization beyond the 12-month period used, especially when their military and civilian jobs match. Indeed, the rapid train-up approach used by the Army appears to be successful in the retraining of IRR medics who have been separated well beyond 3 years. The findings also suggest that it would be a good idea to concentrate on mobilizing high aptitude medics with full active duty tour experience, with priority given to those who perform medical-related tasks in their civilian jobs. The finding that separation interval had only a minimal influence on the retraining success of IRR medics is somewhat contrary to the results reported above for IRR aviators. Thus, across-the-board generalization to other military jobs may be premature. The bulk of the retraining evidence obtained elsewhere (e.g., Kern, Wisher, Sabol, & Farr, 1993), however, suggests that length of separation from active duty may not be as important of a predictor of IRR retraining success as once thought.

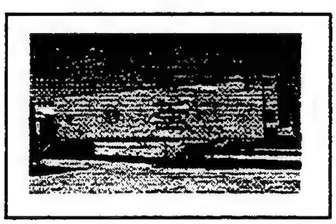
Chapter 3: Overcoming Time Constraints - Unit Tactical and Battle Staff Training

In the last chapter, we discussed ARI products designed to help the RC make the most of available time set aside for individual and crew training. In the present chapter, we extend this discussion to products designed to support ARNG unit tactical and battle staff training. These products take the form of specially developed simulation-based exercises and computer-based courseware lessons. In addition, we provide research findings to suggest that considerable time and costs could be saved by delivering these products via long-distance communications technologies.

Unit Tactical Training

In the early '90s, Congress mandated two development initiatives to enhance ARNG readiness in the areas of unit tactical and battle staff training. The first, called the Reserve Component Virtual Training Program (RCVTP) (now just VTP because of its extension to the AC), was to focus on development of structured, progressive, simulation-based (i.e., Simulation Networking [SIMNET]) exercises for the conduct of platoon-through battalion-level tactical training. The second, called Project SIMITAR, was to focus, in part, on the development of additional simulations and simulators for crew-level gunnery training (see Chapter 2), unit tactical training, battle staff synchronization training, and CBI for CSS units at the individual and staff levels. Products that have been developed by ARI within the context of these two initiatives are described below.

The Virtual Training Program



At the request of NGB, the Defense Advanced Research Projects Agency, and the U.S. Army Armor Center (USAARMC), ARI has developed an extensive set of structured VTP training exercises and after-action review (AAR) materials to enable efficient, SIMNET-based, tactical training during IDT/AT periods at the Mounted Warfare Simulations Training Center, Fort Knox, KY (Campbell, Campbell, Sanders, Flynn, & Myers, 1995).

Platoon and Company Tables

About 100 exercises have been developed for platoon, company, and battalion levels. The platoon and company exercises, called *tables* (or SIMUTA tables because their design and development were completed under the Simulation-Based Multi-Echelon Training Program for Armor Units (Hoffman, Graves, & Koger, 1994), are designed as sequential segments of two battalion missions (i.e., movement-to-contact and defense-in-

sector) frequently performed during NTC rotations. Each table incorporates a prepared operations order (ORORD) with supporting graphics, actions of an intelligent opposing force (OPFOR), and instructions for simulation setup.

The progressive nature of the program is shown in Table 3-1, which shows the 18 tables for the tank platoon (Turecek, Campbell, Myers, & Garth, 1995). Tables C1, C2, and C3, for example, all cover tactical movement, actions on contact, and attack by fire, but vary in difficulty. Table C1 (Easy), for instance, focuses on the platoon leader's ability to command and control in changing tactical situations experienced during a mission to establish a blocking position when a small enemy ground element is encountered. Table C3 (Difficult), in contrast, focuses on fire control and the ability to react to a rapidly changing situation. The platoon attacks by fire, reacts to indirect fire, moves in column along a specified route, and executes actions on contact when both an enemy ground element and anti-aircraft systems are encountered. Similar sets of tables have been developed for the mechanized infantry platoon, scout platoon, tank company, tank and mechanized infantry company/team, and cavalry troop.

Table 3-1. Tank Platoon Tables

Difficulty	*Fundamentals*	*Offense*			*Defense*	
Easy	A1					
	A2, A3	B1			E1	
		B2	C1		E2	F1
		B3	C2	D1	E3	F2
			C3	D2		F3
Difficult				D3		

Observer/Controllers (O/Cs) monitor performance of each table and conduct AARs using workstations which allow the viewing, recording, and play back of the complete battlefield, both in a plan view that mimics typical military graphics, and in a virtual reality view that depicts friendly and threat vehicles on the terrain of the battlefield.

The tables, which take about an hour to complete with AARs provided afterward, can be run back-to-back to step sequentially through a battalion mission. Each successive table introduces new tasks and repeats some tasks from previous tables, thereby creating a learning cycle of practice, feedback, and repeated practice. Up to six tables can be completed in a 12-14 hr day of training.

Battalion/Battalion Task Force Exercises

The exercises for the battalion and battalion task force are run from the unit's crossing of the line of departure to the resolution of the battle (complexities between OPFOR and maneuver forces prevented mission partitioning into tables). Maneuver forces operate in SIMNET vehicle compartments; the battalion staff operates in areas laid out like command posts. Radios provide the communications linkages among the approximately 200 participants. A series of AARs follows mission execution, beginning at the company level and ending with the full battalion. With the assistance of the monitoring and playback technology, O/Cs are able to complete the series of AARs in about 3 hr. In an extended training day, two repetitions of a battalion exercise are possible.

Performance Benefits

VTP has produced steady improvements in unit tactical performance and staff operations. In an assessment of platoon/company performance, for example, O/Cs rated tasks performed by 38 units (33 from the ARNG). In the 137 cases where the same task was rated in at least two exercises *and* the initial rating indicated a problem (train to improve), 67% of the tasks were eventually rated as train to sustain (Figure 3-1) (Schlecter, Bessemer, Nesselroade, & Anthony, 1995).

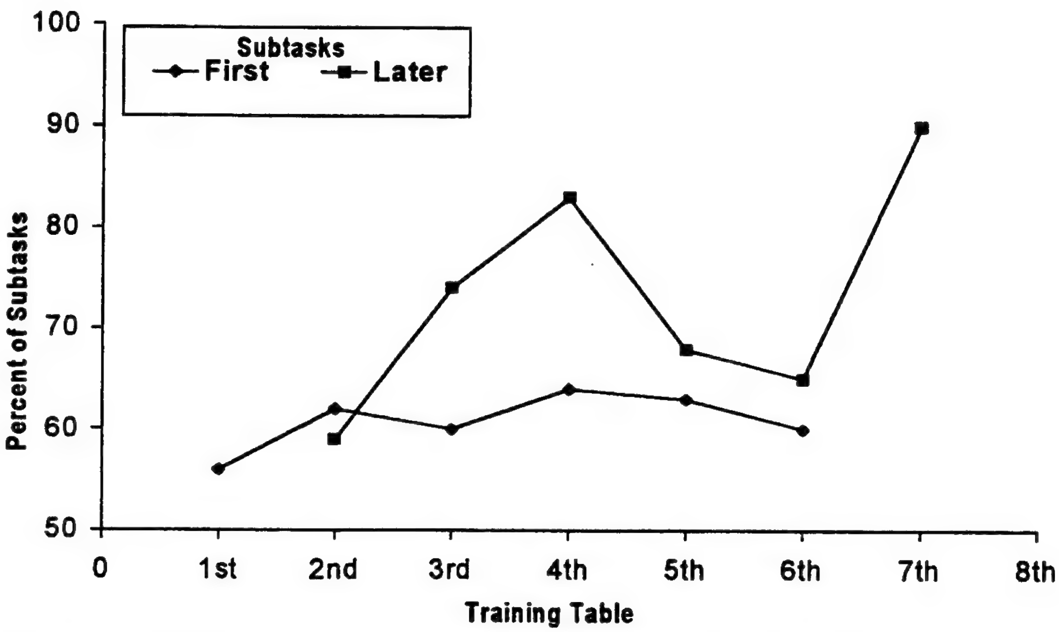


Figure 3-1. Percentage of "first" and "later" subtasks with "train to sustain" ratings for successive training tables.

Further evidence of improved performance has come from unit leaders who rated their own proficiency before and after training. Across all units, leaders saw improvement, but the perception was especially strong among ARNG company leaders. Before training, ARNG company leaders judged their proficiency to be at a lower level

than that perceived by their AC counterparts. After training, both assessments increased, with those for ARNG leaders being very close to those of AC leaders (Figure 3-2).

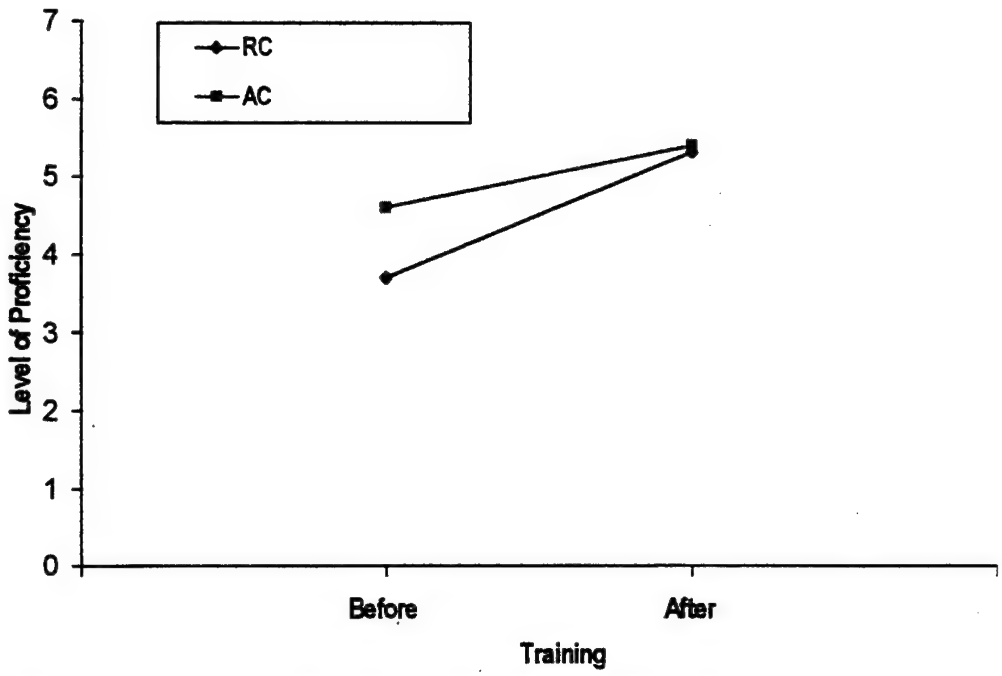


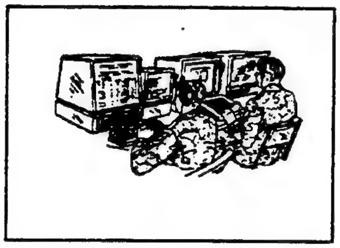
Figure 3-2. Tactical proficiency estimates by unit leaders from ARNG and AC armor companies.

The company-level SIMUTA tables have been developed in such a way as to enable their export to ARNG locations with SIMNET capabilities, thereby reducing the need for selected units to travel to the Fort Knox Mounted Warfare Simulation Training Center. One of these units is the 116th Cavalry Brigade which has been using the SIMUTA tables to help prepare for its Summer, 1998, NTC rotation.

Battle Staff Training

The skill of the battle staff is one of the key determinants of combat effectiveness demonstrated at combat training centers (Keesling, Ford, & Harrison, 1994; Thompson, Pleban, & Valentine, 1994). A successfully synchronized battle staff, (i.e., executive officer [XO], personnel officer [S1], intelligence officer [S2], operations and training officer [S3], S3 air, logistics officer [S4], and fire support officer [FSO]), can obtain and share information, make decisions, and perform effectively and efficiently as a team. To promote such synchronization, VTP includes simulation-based training for ARNG battle staffs.

The Janus-Mediated Staff Exercise and Staff Group Trainer



In support of the VTP initiative, ARI has developed materials for two battle staff training simulations: (a) Janus-Mediated Staff Exercise (JMSE), which provides a battalion/task force staff exercise in command post (CP) operations, and (b) Staff Group Trainer (SGT), which trains principal staff officers on selected techniques to facilitate the flow of information to, from, and between higher, adjacent, subordinate, and supporting headquarters.

JMSE

JMSE-based exercises were developed to be compatible with SIMNET-based, battalion-level tactical training. Like the exercises on SIMNET, JMSE-based exercises focus on the execution phase of movement-to-contact and defense-in-sector missions, both conducted on simulated NTC terrain. The battalion being trained operates the Main CP (to include the S2, S3, S3 section, and FSO) and the Combat Trains CP (CTCP) (to include the S1 and S4).

JMSE exercises are conducted by the exercise control group and observers. The exercise control group operates the Janus workstations and controls the actions of the simulated subordinate/supporting units, OPFOR, and brigade headquarters. The subordinate and supporting unit controllers respond to directions from the CP/CTCP much like real units would. Observers record events and provide feedback to the participating unit.

Besides designing the structure for JMSE, ARI has developed JMSE's supporting materials, to include planning materials for the battalion task force and the simulated brigade. For the battalion task force, materials include a full OPORD, the commander's intent, a decision support template, and overlays. To enable interaction with higher headquarters, the brigade materials include a brigade OPORD with appropriate annexes, scripted message traffic, and guidance to deal with unscripted situations. Because one of the goals for JMSE was to provide an intelligent, doctrinal OPFOR, ARI has developed an OPFOR scenario that includes contingency plans, commander's intent, adjacent unit activities, reinforcement options, priority of fires, and decision points.

To support control of the exercise, ARI has also developed individual workbooks for each of the nine controllers required to conduct JMSE-based training. The workbooks include guidance on operating the workstations, as well as information specific to each exercise. In order to ensure systematic feedback, ARI has prepared workbooks for the Senior CP observer, the three observers who monitor activities in the Main CP (S3/S3 section, S2, and FSO), and the S1/S4 observer in the CTCP. The observer workbooks include training objectives for known events or scripted message traffic, as well as for recurring tasks (e.g., maintaining logs) (Campbell, Campbell, Sanders, Flynn, & Myers, 1995).

Performance Benefits

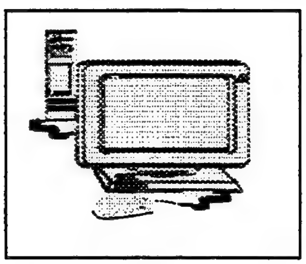
ARNG battle staff officers who participated in the initial tryouts of JMSE thought that the exercise improved their skill proficiency (Hoffman, Graves, & Koger, 1995). Those from one battalion, for instance, noticed that they could see improvements in their performance after transitioning from JMSE- to SIMNET-based training. In comparing JMSE with other staff training options, the officers indicated that they had never participated in an exercise as realistic as JMSE.

The tryouts also confirmed that both the movement-to-contact and the defense-in-sector missions could be conducted over a MUTA-5 IDT weekend. The recommended schedule is shown in Table 3-2

Table 3-2. Sample of MUTA 5 IDT Weekend for JMSE.

Friday Night		
	• Receive orientation from the VTP JMSE team	1.0 hr
	• Begin preparing the JMSE CP/CTCP for the exercise	
	• Review orders and plans	
Saturday		
	• Complete CP/CTCP preparation	1.0 hr
	• Conduct orders brief/rehearsals	1.0 hr
	• Execute JMSE Movement-to-Contact Exercise	1.5-2.0 hr
	• Conduct AARs	2.5 hr
Sunday		
	• Complete CP/CTCP preparation	1.0 hr
	• Conduct orders brief/rehearsals	1.0 hr
	• Execute JMSE Defense-in-Sector Exercise	3.0-3.5 hr
	• Conduct AARs	2.5 hr

The Staff Group Trainer



The SGT is intended to train procedures needed to process information within the context of a movement-to-contact mission BDM Federal, Inc., PRC Inc., and Human Resources Research Organization, 1994). The exercises involve the battalion commander, XO, S1, S2, either the S3 or the S3 air, S4, and FSO.

SGT exercises are conducted on a local area network that permits staff officers and the battalion commander to exchange digital information over a radio network (e.g., the command net). A SGT workstation is shown in Figure 3-3. The map display monitor allows staff officers to create and edit digital overlays similar to acetate overlays used in

the field. The message monitor enables participants to receive incoming reports, view the details of a report, create new reports, copy a report to a folder, or forward a report to another workstation over the network. Exercise difficulty can be controlled by changing the speed of incoming reports.

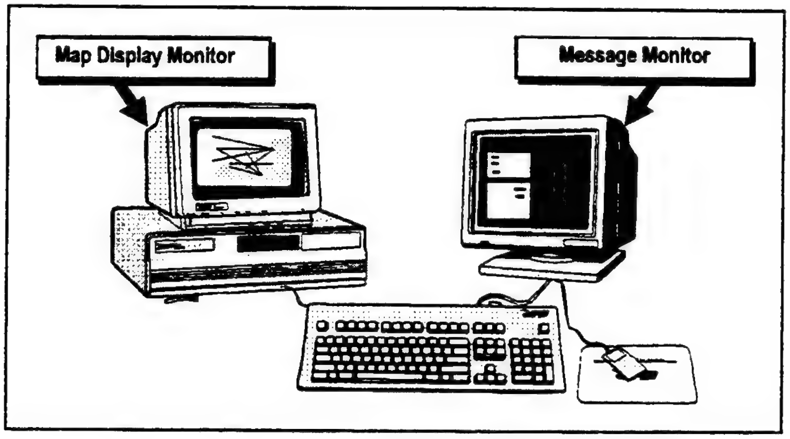


Figure 3-3. Example of an SGT workstation.

ARI has developed the tactical situation for the SGT movement-to-contact mission and prepared all messages associated with its execution. Because the tactical situation is scripted, ARI was also able to develop very detailed AAR materials. These materials were based on extensive reviews by military subject matter experts (SMEs) of how they would respond to the message, to include updating of the situation map. SGT technology allows trainers to compare the message actions, situation reports, and overlays developed by staff officers being trained with the associated SME versions after each segment of the mission.

Performance Benefits

Tryouts of SGT have confirmed the efficiency of the simulation for providing experience on compiling, interpreting, and assimilating information needed to develop the clearest possible picture of the battlefield. In addition, the combat reports used in SGT served as models, increasing the likelihood that staff officers would request additional information from their supporting units in a standard tactical CP. Tryouts have also shown that the SGT exercise can be completed during a typical MUTA-4 IDT weekend.

Conclusions

Because of ARI's support of JMSE and SGT, the ARNG now has he ability to conduct progressive staff training during IDT: low-difficulty staff training with SGT followed by a demanding, more realistic full-staff exercise with JMSE. Work on SGT is continuing to enhance the effectiveness of the simulation, to extend its application to brigade-level operations, and to cover deliberate attack and defensive missions.

The Battalion Battle Staff Training System

In conjunction with the Defense Advanced Project's Research Agency and the ARNG, ARI has supported two, Project SIMITAR-related, CBI-based courseware development initiatives collectively known as the Battle Staff Training System [BSTS]). This courseware provides opportunities for the learning and practice of battalion and brigade battle staff synchronization skills, and for CSS staff/units to learn and practice selected supply-, maintenance-, and medical-related tasks/exercises. The products of each initiative are designed for individualized, self-paced, on-demand use at home or at the local armory/reserve center (Krug & Pickell, 1996).

Courseware

The CBI courseware (consisting of text and CD ROM-based graphics, still photographs, audio, and full-motion video with audio) was developed by two teams of SMEs, instructional designers, and CBI experts located at different sites; one team developed the courseware for the battle staff of the mechanized infantry battalion/task force and for the battle staff of the armored brigade, the other developed the courseware for staff members of the forward support battalion (FSB) and its counterpart in the separate brigade--the support battalion (SB)--as well as for NCOs and officers in FSB companies.

The Mechanized Infantry Battalion/Task Force. The courseware developed for the mechanized infantry battalion/task force addresses 12 staff positions: XO, S1, S2, S3, S3 air, S4, FSO, engineer officer, air defense coordinator, signal officer, chemical officer, and chaplain. In addition, common core instruction was developed to give each officer a basic understanding of doctrine, tactical employment of the battalion/task force, and its roles, missions, and capabilities.

Thirteen courses of instruction (about 400 hr) have been designed for use under the BN-BSTS program. Their structure and scope are illustrated by the course outline for the S3, shown in Figure 3-4 (BDM Federal, 1995). All feature automated training management capabilities needed for student scheduling, performance assessment, progress tracking, and so forth. Each course also contains a listing of detailed training objectives and associated reference materials needed for successful completion (BDM Federal, 1995).

The Armored Brigade. The development model used to develop the battalion-level materials was also used to develop the CBI courseware for the battle staff of the armored brigade. Besides the necessary changes in content, a course was added for the civil-military operations officer (S5) and the courses for the S1 and chaplain were combined (André & Salter, 1996).

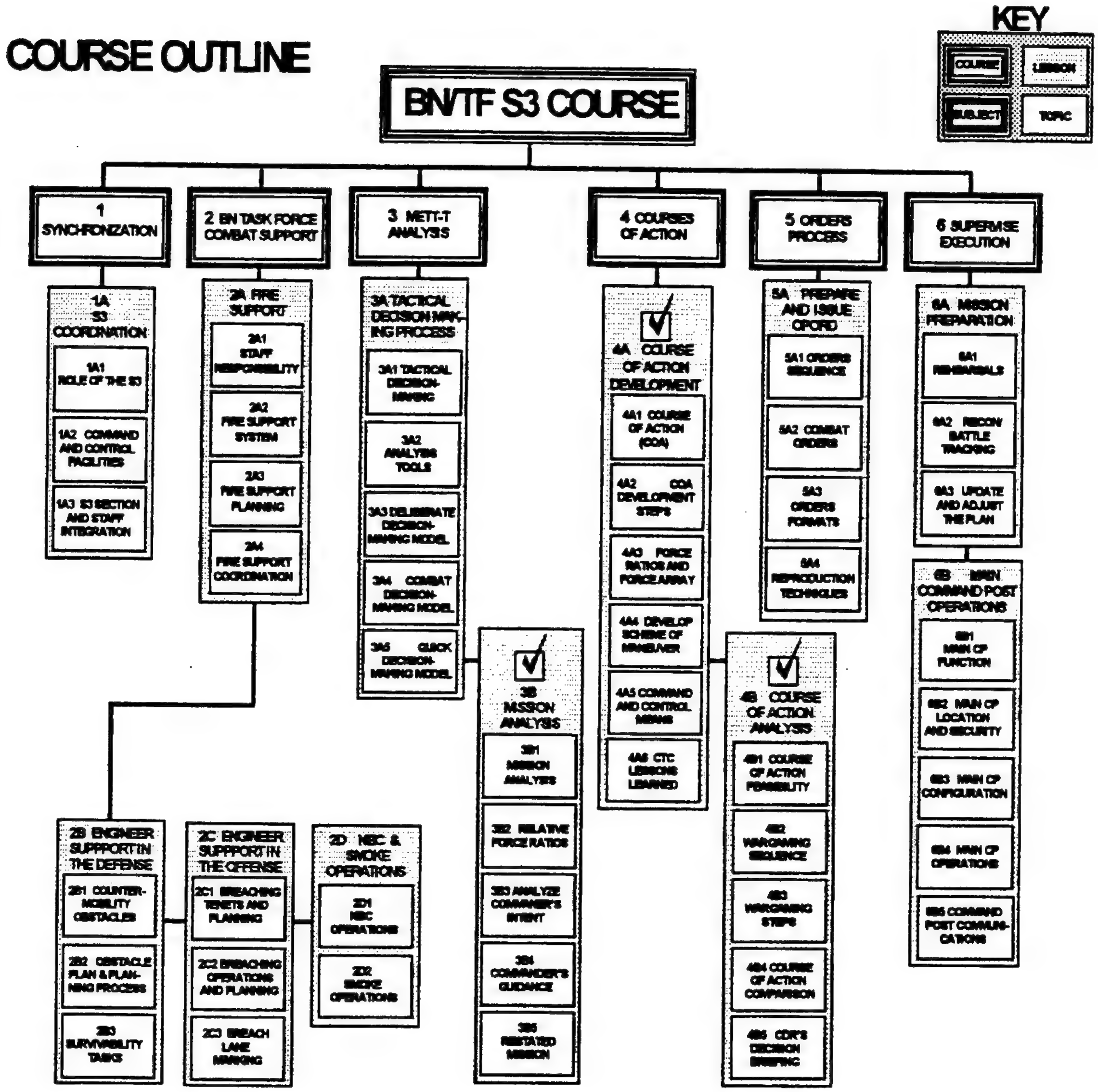


Figure 3-4. Course map for battalion/task force S3.

The FSB and SB. Courses were also developed for the FSB and SB using the mechanized infantry battalion/task force model. In most cases, ARI modified the content of the above courseware to fit FSB and SB staff positions. Two positions, however, are unique to the FSB and SB and required new development. The first position is the support operations officer (SPO), who manages the CSS companies and coordinates transportation and field services in the FSB. The second position is the brigade material management officer (BMMO), who manages supply and maintenance and controls the property book in the SB.

The courses consist of six lessons for the SPO, five for the BMMO, and one shared lesson. Each lesson provides guided practice on interpreting and processing information, and applying it to answer questions and perform tasks presented (with feedback) every 2-4 min.

Performance Benefits

As part of formative evaluation procedures, officers and NCOs worked through the lessons, and the pre-and posttests of each course. The pre- and posttest results are shown in Table 3-3 (André & Salter, 1995, 1996; Keesling, 1995) for each course. In all cases, task performance scores improved from pre- to posttesting.

Table 3-3. Average Pre- and Posttest Scores by Course

Course	*No. of Test Soldiers*	*Pretest Score*	*Posttest Score*
Battalion/Task Force Staff	21	63	88
Brigade Staff	43	66	91
FSB and SB CBI	15	69	87
FSB Companies	70	61	85

Course completion times were also recorded during the formative evaluations. In general, the results indicated that most of the mechanized infantry battalion/task force and brigade staff training will require about 60 hr, evenly divided between the common core and position-specific training (Andre & Salter, 1995, 1996). Time requirements for the position-specific training will range from 6 hr for the battalion/task force chaplain to 63 hr for the battalion/task force FSO. The FSB/SB staff CBI will take about 1 hr per lesson (Deterline & Keesling, 1995).

Conclusions

A considerable number of CBI-based lessons have been developed to train critical battle staff skills. The efforts described above have developed almost 300 lessons with about 120 lessons including, or solely composed of, CBI. Because of its CBI basis, this training has the flexibility to be conducted in a self-paced mode via stand-alone computer at home or armory, or via modem in a network configuration at state academies.

Remote Delivery of a Command Post Exercise

Much of the above described battle staff training development work has been conducted with an eye toward not only increasing productive use of available training time, but also toward reducing the time and costs required for travel (i.e., "windshield time") to and from the training site. This is based on the assumption that communications technologies can be used to bridge the distance gap between units/participants without degrading the quality of their training.

ARI first investigated the validity of this assumption back in the mid '80s by examining the feasibility and cost of conducting a remote Command Post Exercise (CPX)

wherein geographically dispersed battle staffs intercommunicate from their home stations through the use of long-distance communications technology (Smith, Hagman, & Bowne, 1987). Normally, CPXs are conducted at a common location for the purpose of providing battalion staffs with an opportunity to work together, and with brigade headquarters, to enhance synchronization (teamwork) and refine standard operating procedures. The questions to be answered were whether or not CPX objectives could be accomplished from a distance (i.e., without the need for participant travel) and at what cost.

Approach

At the request of the Idaho ARNG, command groups from three battalion-level units (from separate states) participated in a 3-day remote Computer Assisted Map Maneuver Simulation-driven CPX. CPs were established for each battalion-level unit, the brigade-level command, and the corps. Participants communicated over commercial telephones, fitted with external speakers and microphones, rather than via tactical FM radios. In addition, slow-scan TV transceivers and facsimile machines were used to transmit graphic and textual information. After the exercise was over, ARI asked participants (via paper-and-pencil survey) about its training benefit, and derived cost figures for a standard (i.e., on-site) and a remotely delivered CPX.

Findings

Effectiveness. The after action report filed by the Exercise Director of the 75th Maneuver Training Command (the exercise controllers) stated "the communications equipment and training on its use presented a challenge that most participants met admirably." This report also stated "the training objectives were met with the exception of the conduct of rear area security. This was planned for, although time did not permit its execution."

Cost. Cost data revealed that substantial savings could be achieved through remote delivery. Figure 3-5 depicts the predicted cost per exercise of a standard CPX (requiring travel to a common site) and the remotely conducted CPX (under both leased and purchased communications equipment options) with the same participating units. These data revealed that a remotely conducted exercise with leased equipment would be the least expensive option if only a single exercise were conducted. Under a purchase option, the first remote exercise would be more expensive to conduct than a standard exercise because of the initial equipment investment cost. This cost could be fully amortized, however, after only two remote exercise iterations. From then on, the cost savings would favor remote delivery.

Conclusions

These findings demonstrate that remotely conducted battle staff training can be effective and less costly than traditional battle staff training that require participant travel to a common location. With the development of more sophisticated communication equipment since conduct of this research (e.g., video teleconferencing, local and long-

haul area networking over phone lines), remotely conducted battle staff training may be even more cost effective than ever. Recently, the Idaho ARNG, for example, has demonstrated that effective training can indeed be brought to units/soldiers through successful conduct of JMSE exercises over a statewide long-haul area network.

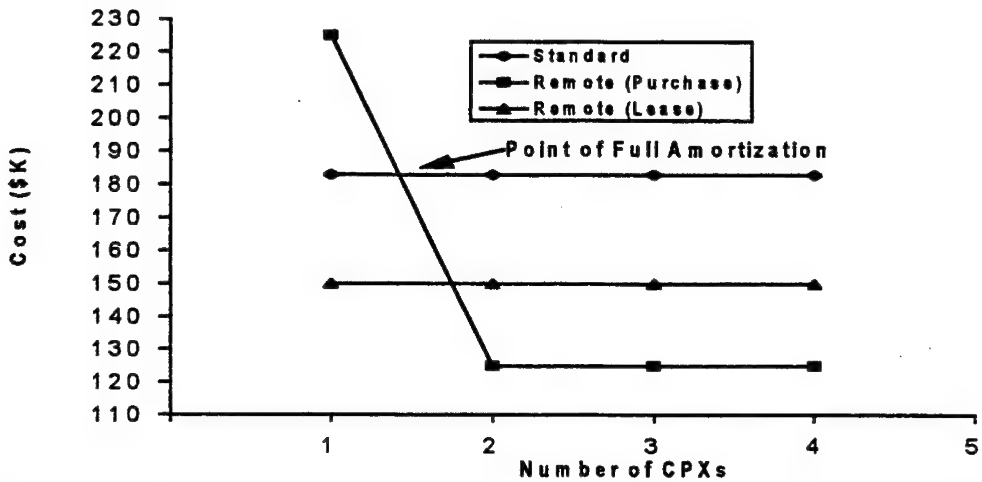


Figure 3-5. Cost per exercise iteration for standard and remote CPX with leased and purchased communications equipment.

Certainly, the notion of remotely conducted training is one that promises future rewards for the RC as it strives to deliver effective training to its soldiers at a reasonable cost. Additional ARI products designed to facilitate training from a distance are described in the next chapter.

Chapter 4: Overcoming Dispersion Constraints - Distance Learning and the Electronic Classroom

As the RC strives to attain and maintain total force readiness standards, one of the major challenges it must overcome is how best to train its geographically dispersed soldiers and units (see Chapter 1). This dispersion tends to restrict the conduct of training to what can be accomplished at the local armory or reserve center. It also forces soldiers and units to spend a significant portion of available training time on travel when classroom attendance (e.g., for MOS reclassification, professional development) or assembly at an organizational level higher than company (e.g., battalion, brigade) is required.

For some time now, ARI has recognized this challenge and has investigated the use of long distance communications technologies to help bring training to soldiers rather than vice versa. In this chapter, we describe some of ARI's efforts designed with this goal in mind.

Distance Learning

Training and retraining demands on RC units have increased in recent years because of the rise in the number of RC deployments, increased individual and unit reclassifications resulting from force structure changes (Ramsberger, Knerr, McKinney, Sticha, Kronholm, & Gividen, 1996), and a parallel reduction in the number of resident school seats.

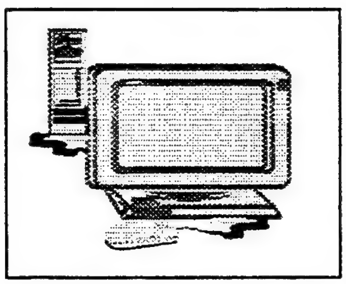
MOS and branch qualification pose particular problems because low qualification rates affect both unit and soldier readiness status for deployment. One solution, proposed by RC soldiers themselves (see Chapter 2), is to increase the availability of training at soldiers' homes and home stations through use of distance learning (DL) technologies. This should make training more available and, at the same time, reduce travel time and costs.

While Army emphasis on DL has intensified only recently, ARI has been conducting DL research since the mid '80s. In fact, ARI's DL program began in 1986 at the request of the Vice Chief of Staff of the Army. One of his top staff officers was taking a civilian course under a then new concept, called asynchronous computer conferencing (ACC), that allowed students and instructors to participate from anywhere in the world at anytime of the day or night. This flexibility to provide "anytime-anywhere" training seemed a natural alternative to having RC soldiers leave their homes and units for purposes of training.

Analysis of the civilian course taken by the Vice Chief's staff officer showed that ACC was not just a resident course exported elsewhere. It was a new model for training in which the instructor did not "lecture" from afar but served as a discussion facilitator and course manager. The computer conferencing technology allowed students and instructors to communicate and provided the shell, or environment, within which courseware was delivered via other media (e.g., print, video, CBI). Thus, what initially appeared to be an investigation of a new electronic course delivery technology turned out to be the development and evaluation of a new DL model that not only would make training available anytime-anywhere, but also would change the way courses are developed, the role of instructors, and even current training policies. Over the last 12 years, ARI's research efforts have defined these changes and documented the procedures required for moving from a primarily resident training system to a more flexible DL system.

ARI's DL work program has included three phases. The first phase produced a decision tool to help match delivery media with training course characteristics. In the second phase, ARI developed and conducted experimental Army ACC-based courses to evaluate their cost and effectiveness and identify what changes they might require to the course development process, the role of instructors, and to training policies themselves. In the third phase, ARI is currently assisting the RC in its own DL implementation in communities throughout the country.

Asynchronous vs. Synchronous Delivery



The first question that must be answered before developing a DL course from scratch, or converting an existing resident course to a DL format, is whether courseware should be delivered synchronously, asynchronously, or both. Synchronous delivery requires simultaneous, real-time interaction between the instructor and the student using communications technologies such as audio/video conferencing. In contrast, asynchronous delivery does not require the instructor and student to interact concurrently and uses technologies such as CBI, interactive videodisc-based training, and computer conferencing. While both synchronous and asynchronous delivery are possible in many situations, the question is which of these two delivery options should be used and when.

To help answer this question, ARI has developed a simple tool for training course developers to use in deciding which delivery option(s) to adopt on the basis of desired training course characteristics (Hagman & Dykstra, 1988).

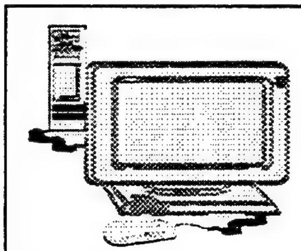
The multiple-choice questions asked by this decision tool, and the implications of their answers in regard to delivery mode selection, are summarized in Table 4-1. Synchronous delivery should be considered a viable option, for example, when large numbers of trainees are available at the same time and location(s), when training is to be provided only at scheduled times, when progress is group paced, and when training is not

automated. In contrast, asynchronous delivery should be considered a viable option when trainees are geographically dispersed, when training is to be delivered on demand, and when training is automated. In general, Table 4-1 suggests that neither delivery mode is inherently better than the other and that a decision about which to use and when depends on the specific situation.

Table 4-1. Course Characteristics to Consider When Determining DL Delivery Mode.

Characteristics	*Synchronous*	*Asynchronous*
Training offered	Only at scheduled times	On demand
Number of trainees per site	Many	Few
Pace controlled by	Trainers or groups of trainees	Individual trainees and trainer
Feedback given to	Group	Individual trainees or group
Training sequence	Fixed	Flexible
Training automated	No	Yes
Training strategy	Lecture, group study, simulation	Group study, drill and practice, tutorial, simulation

Asynchronous Computer Conferencing



Because RC soldiers typically hold full-time civilian jobs and part-time military jobs, ARI's research since the mid '80s has focused on DL technologies that are likely to fit into such demanding work schedules. Asynchronous technologies, that enable instructor-trainee interactions to occur anytime-anywhere, appeared to offer the most promising solution to this scheduling problem (e.g., Phelps, Ashworth, Wells, & Hahn, 1991).

As a result, ARI completed a 5-year, programmatic research effort to examine the use of a DL technology, called ACC, for RC training. ACC enables trainees to communicate with an instructor and one another at different times and from different locations via computers and existing telephone-line-based, Internet-like networks. The result is creation of a distributed, "on-line," instructor-facilitated, electronic classroom wherein trainees participate in discussions, are assigned homework, take tests, and receive feedback from a distance.

Approach

The potential benefits of ACC were examined within the context of an Engineer Officer Advanced Course (EOAC) module and the common core segment of the Basic NCO Course (BNCOC). The EOAC module was first converted to support ACC-based delivery, administered, and studied in detail; then lessons learned from it were extended to BNCOC. Performance (e.g., on tests, homework, and class projects), course completion, and student/instructor evaluation data were collected for each course.

EOAC. The EOAC module covered nine topics, e.g., airfield damage repair, military petroleum pipelines, asphalt production, flexible pavement structures, roads and airfields, military bridges, and rear operations. It culminated with a capstone practical exercise that placed trainee groups in a simulated combat environment in which they were to develop plans and then brief them to a field grade officer. The instructional materials were converted to an ACC format using media appropriate for DL. The percentage of course hours devoted to particular media/activities is shown in Table 4-2 (Phelps, Ashworth, & Hahn, 1991). Table 4-3 shows the specific variety of media/materials used in conjunction with ACC delivery of the asphalt production lesson of the EOAC module (Hahn, Harbour, Wells, Schurman, & Daveline, 1990).

Table 4-2. Media/Task Percentages.

Media/Activities	*Percentage of Hours Spent*
CBI	19
Team Synchronous Activities	4
Team Asynchronous Activities	20
Video	2
Print	41
Testing/Review Activities	14

Fourteen RC captains and lieutenants participated in the EOAC module. Each was lent a personal computer with preloaded courseware. The instructional staff consisted of a USAR course manager/administrator who was responsible for the overall operation of the course and the supervision of four USAR instructors who monitored trainee progress, directed group discussions, and conducted remedial instruction (Phelps, 1993)

Initially, trainees were allowed to work through the first five topics of the EOAC module at their own pace. This didn't work very well, however. Indeed, one review concluded that "when trainees were allowed to proceed at their own pace, they scarcely progressed at all" (Wells, 1990, p. 38). Because of the slow progress found under self-pacing, instructor pacing was instituted. The latter pacing approach included establishing deadlines (with penalties and incentives) and increasing group activities. As shown in

Figure 4-1, progress improved considerably after instructor pacing was imposed (at Topic 6) and was more in line with initial expectations of the staff.

Table 4-3. Media Selection for Asphalt Production.

Activity	*Media*
Overview of mix plant and paving operations	Paper reading assignment--need to show visuals; no need for feedback during presentation.
Aggregate blending	Spreadsheet exercise--has many iterative calculations so use of spreadsheet will ease student burden; one drawback is the lack of feedback during the exercise. Contingency activity (anticipated for remediation)--computer-assisted instruction that provides feedback on each step of the exercise.
Optimum asphalt content	Computer-assisted instruction with workbook--exercise would benefit from ability to provide feedback at each step because of quantitative nature; workbook provides hardcopy materials.
Bill of materials	Paper-based exercise--also calculational in nature; must design activity with internal checkpoints.
Review	Asynchronous and synchronous group discussions--use a roundtable where questions are directed at each student and their answers discussed so that all must prepare for the session.

A control group consisted of RC officers who were trained on the EOAC module in residence at the Engineer School during fiscal years 1987, 1988, and 1989. Comparison data were collected on tests, homework, the capstone exercise, and pre- and postsurveys (Hahn, Ashworth, Phelps, Wells, Richards, & Daveline, 1991).

BNCOC. The lessons learned from the work with the EOAC module were applied to the conversion of BNCOC common core instruction to an ACC-based DL format. Course content covered leadership skills, the promotion system, training management procedures, property accountability, and map reading. The media included CBI, videotapes, and paper-based materials.

Thirty one NCOs began the course under ACC delivery and the controlled pacing conditions found to work for the EOAC module. A control group of 32 NCOs began the course as "residents" at a Reserve Forces school.

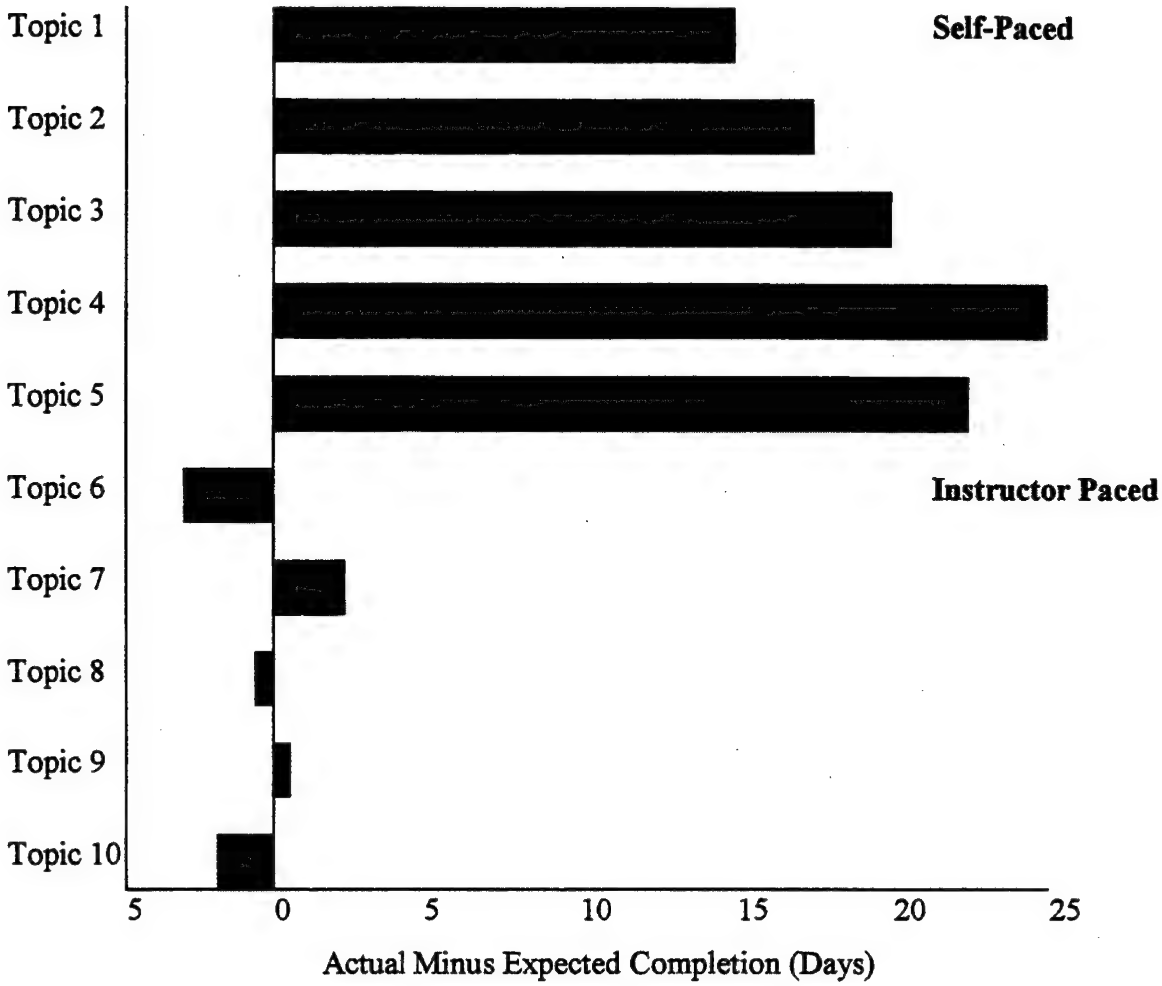


Figure 4-1. EOAC module progress under self- (Topics 1-5) and instructor (Topics 6-10) pacing.

Findings

Effectiveness. As shown in Table 4-4, the test performance of trainees in both ACC courses was about equal to, or better than, the test performance of resident (control group) trainees. EOAC ACC trainees also demonstrated performance levels on homework and on the culminating capstone exercise similar to those of their resident counterparts. Comparison of EOAC trainees' self-ratings of their skills and knowledges before and after module completion also showed significantly greater gains under ACC delivery.

Table 4-4. ACC Effectiveness.				
Performance	***EOAC***		***BNCOC***	
	ACC	*Resident*	*ACC*	*Resident*
Test Scores	91%	90%	84%	75%
Completion Rates	64%	95%	90%	96%

Throughput. Of the 14 officers who began the EOAC course, three formally dropped out prior to the start of the module and two failed to complete the assignments required for course completion. As shown in Table 4-4, this 64% completion rate was substantially lower than the 95% throughput typically reported for resident training. The EOAC ACC completion rate, however, was probably at the low end of what could be expected because of formative issues that would not have arisen under a fully developed course implementation (Wells, 1990). The throughput improvement shown in Table 4-4 for BNCOC supports this notion. Furthermore, both ACC-based courses had better completion rates than the 50% completion rate typically associated with paper-based correspondence courses (Hahn et al., 1991).

Time and Cost. Work with the EOAC module also gave ARI an opportunity to (a) document the time required to convert the existing resident course module to an ACC format, and (b) compare the associated costs of ACC and resident module delivery. The staff hours needed to complete ACC materials development and course conversion are shown in Table 4-5 (Hahn et al., 1991). Clearly, the down side to ACC-based delivery is that it can entail major alterations in both resident course material and media (Phelps et. al., 1991). The up side, however, is that these conversion efforts are nonrecurring, making ACC a less costly option in the long run.

Table 4-5. Staff Hours Required for ACC-based Course Conversion.		
Category	***Staff Hours***	***Percentage of Effort***
Requirements Analysis	435	10
Design	163	4
Conversion	2,588	61
CBI/Slide Production	812	19
Video Tape Production	251	6
Totals	4,249	100

The cost for ACC was calculated by adding the cost for conversion (using TRADOC training developers) to that for execution. The results were then compared with the cost of delivering resident training so that 50 trainees would complete each course (which accounts for the throughput advantage for resident training). The comparison over 10 course iterations revealed that ACC would save almost half the cost of resident training.

How to Conduct ACC-Based Training. ARI efforts to answer the question of how to best conduct ACC-based training for the RC have led to the following five recommendations:

- ***Establish a flexible but firm schedule***. The experience with EOAC indicated, and that with BNCOC confirmed, that deadlines are essential to keep trainees moving. These deadlines should be spaced to give a reasonable amount of flexibility, but not so far apart as to encourage procrastination.

- ***Incorporate high student-instructor interaction***. For the EOAC module, for instance, the primary instructor received 388 telephone calls and 426 online messages. In addition, the instructor called and contacted trainees on line in order to provide frequent feedback on tests and related assignments.

- ***Expect no more than 10 hr of trainee time per week***. EOAC and BNCOC trainees indicated that they could reasonably devote an average of 8 hr per week to course related activities and that 10 hr would be the maximum that could be expected.

- ***Establish incentives and sanctions***. For the schedule to be meaningful, there should be bonus points for early lesson completion and deductions for being late. The incentives and sanctions must, of course, be compatible with the policies applied to resident training.

- ***Incorporate group activities***. Experience in both courses confirmed that group activities were a valuable pacing aid (trainees did not want to disappoint other members of their group) and enhanced trainee motivation.

Conclusions

As a result of ARI's seminal work with ACC, the RC can make an informed judgment about the practicality of ACC-based DL. ACC-based delivery can support development of skill levels comparable to those achieved via resident training with costs that are similar or less, even allowing for differences in throughput.

By-products

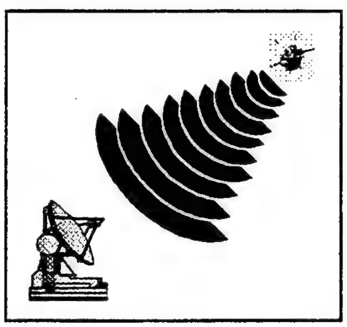
During conduct of the above research, three by-products were developed to promote successful RC training via DL technologies in the future. The first is a general

review of the DL literature. This review includes the findings of past DL implementation efforts, practical knowledge on how to design and implement DL (example topics include frequency of feedback, design and implementation of group activities, shifts in instructor role under a DL environment, characteristics of successful DL trainees and instructors, and pacing recommendations), and a reference guide to international DL resources (Wells, 1990).

The second is a job aid to assist instructors in the conduct of training via DL delivery (Harbour, Daveline, Schurman, Richards, Hahn, & Wells, 1990). This product contains a wealth of information on successful individual and group DL techniques, as well as suggestions on how to motivate DL trainees, how to identify those unlikely to benefit from a DL approach (i.e., high-risk trainees), and how to troubleshoot trainee problems that may arise.

The third provides course developers and managers with guidance on how to implement computer-mediated training in accordance with the systems approach to training (Hahn et al., 1991). Specific guidelines are provided for the analysis, design, and development/conversion of DL courses that involve asynchronous, computer-mediated delivery.

An Implementation Strategy for Distance Learning



Interest in the use of DL technologies to improve RC soldiers' access to training has increased considerably since completion of the above seminal work. Recently, for instance, the Chief of Staff of the Army has directed TRADOC to work toward converting selected resident courses to a combination of resident training and DL or to all DL (U.S. Army Training and Doctrine Command, 1996) (See www-tradoc.army.mil for the latest updates.). In addition, the National Defense Authorization Act of 1995 has directed NGB to establish a DL program of its own. In response to this directive, NGB is establishing regional networks of DL classroom sites located within a 90-min commute (eventually to be within 60 min) of all ARNG soldiers. Each site will have a multimedia audio teleconferencing station and a video satellite downlink to support synchronous delivery, and a personal computer, interactive graphics tablet and software, videotape player/recorder, and 35" television monitor to support asynchronous delivery. Some sites will also include a local area network of 12 multimedia personal computers.

Approach

The first step being taken to establish the regional networks is to develop a demonstration network covering Maryland, Pennsylvania, Virginia, West Virginia, and the District of Columbia (Figure 4-2). ARI is supporting the establishment of these networks by developing criteria for prioritizing courses for DL, developing an inventory

of DL courseware, outlining an approach for shared military/community access, and developing demonstration training.

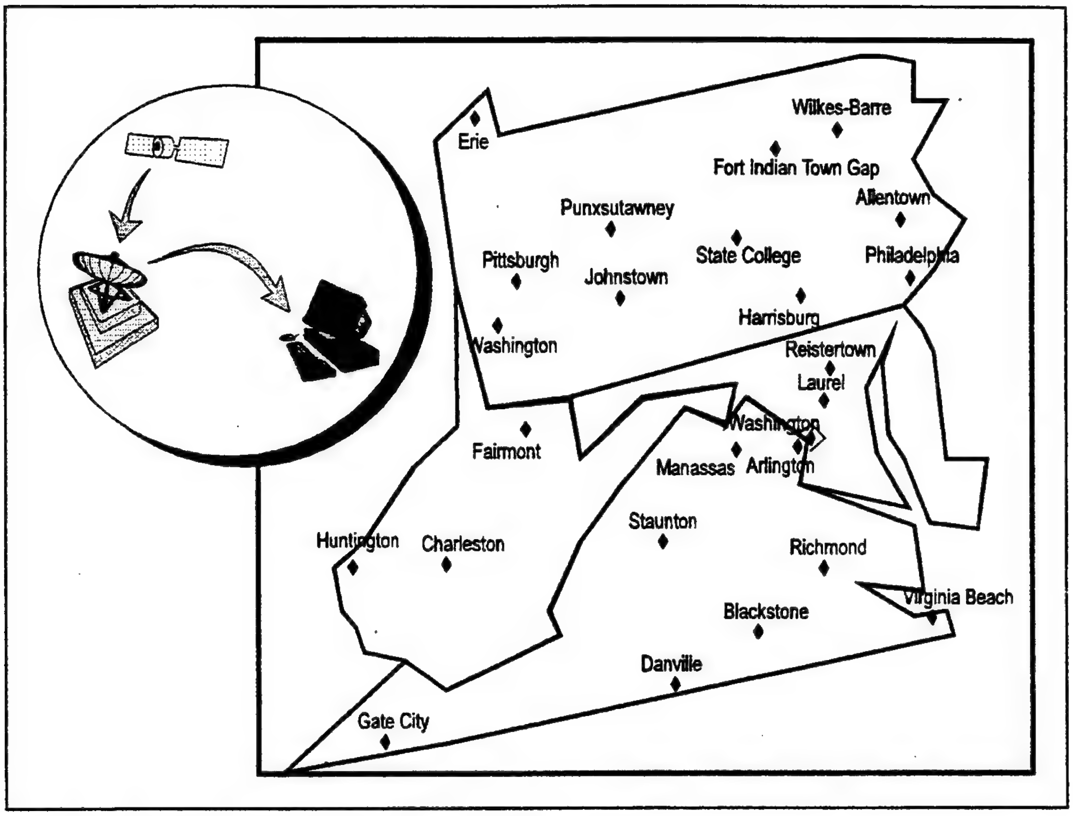


Figure 4-2. Map of prototype regional network.

Develop Criteria for Prioritizing Courses for DL. TRADOC has the responsibility for Army-wide conversion of military courses to a DL format (U.S. Army Training and Doctrine Command, 1996). Criteria used for determining which courses to convert and when include consideration of the number of MOS-unqualified soldiers, changes to unit missions, restructuring of jobs, changes to doctrine or technology, proponent school recommendations, training load, MOS density, and the availability of existing training materials. ARI is assisting TRADOC in this prioritization process by developing a system (method) for deciding which courses to convert on the basis of the above-mentioned criteria (Ramsberger, Knerr, McKinney, Sticha, Kronholm, & Gividen, 1996). As regional networks are established, this system (see Figure 4-3) will enable leaders to select high priority courses for each region.

Develop Inventory of DL Courseware. The first step in deciding which courses to convert to a DL format is to eliminate courses that have already been developed (Figure 3-2). To help with this decision, ARI has developed a computerized inventory of existing DL courses. These courses were identified from sources within the U.S. Department of Defense (e.g., Defense Instructional Technology Information System), other Federal agencies (e.g., Department of Energy Central Training Academy), and commercial producers (e.g., Health Professional Database). The resulting inventory links

to other databases containing over 14,000 courses and provides descriptions of nearly 300 others (Human Resources Research Organization, 1996).

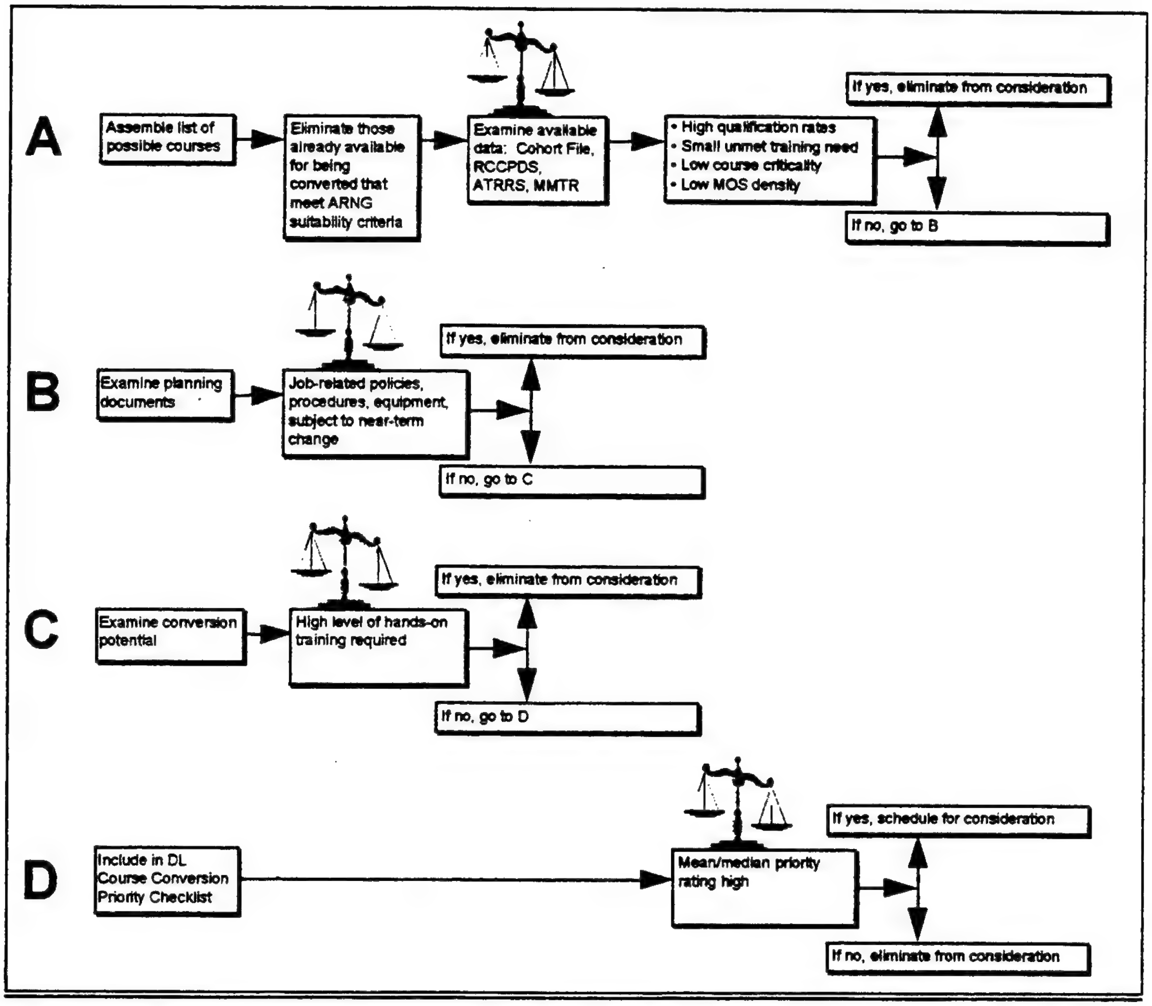


Figure 4-3. System for selecting courses for DL conversion.

Develop Approach for Shared Access. In acknowledgment of the role that the ARNG plays in local communities, the DL regional network plan emphasizes shared usage by the ARNG and civilian organizations (e.g., to provide the latter with opportunities for continuing education). To facilitate shared access, ARI has developed guidance for involving civilians in DL at armory locations. Recommended activities include establishing a military point of contact to introduce the network to the community, identifying civilian points of contact, informing local media, and demonstrating network usage (Ramsberger et al., 1996).

Evaluate Functional Training Events. These events are satellite-delivered briefings for members of the ARNG and other government agencies. Topics have included terrorism, counter-drug operations, and risk management. Participant feedback has confirmed the efficacy of providing such briefings under a DL format.

Convert and Evaluate Courses. ARI has supported both conversion of institutional courses and development of their content modules. When institutional courses are converted for ARNG use, they are restructured to fit into a maximum of 48, 4-hr blocks with no more than 15 days of accompanying resident training. For example, the course for MOS 93C (Air Traffic Controller) is being conducted with 21 students from eight states. This course includes a DL portion plus 2 weeks of resident training to cover tower operations and radar.

In addition to assisting with the conversion of institutional courses, ARI is applying DL technologies in support of specific training course requirements. One such application is the development and evaluation of the Combat Lifesaver Course converted to a DL format that includes a combination of interactive television and CD-ROM. Because this course is a response to the requirement that one soldier in each infantry squad (AC and ARNG) should be qualified as a combat lifesaver, it promises major savings in travel and per diem costs.

Cost savings have already been found by ARI for the 71L Unit Clerk course normally conducted in residence (Wisher, Priest, and Glover, 1997). ARI comparisons of student performance and costs showed that when the 71L course was taught under DL, test scores were an average of 8% higher and costs were $1135/student less than for the same course taught in residence. These findings confirm the earlier results obtained with ACC, indicating that DL savings can occur across different DL technologies.

Conclusions

As part of the Army's major commitment to DL, the ARNG has begun to establish a prototype regional network of DL sites at which soldiers can receive the desired training. ARI is supporting TRADOC and the ARNG by helping with the identification of existing courses available for DL delivery, development of the content of courses to be delivered, and creation of a model for shared regional network usage. As more courses are delivered over this network, ARI will continue to assist in evaluating their cost and effectiveness and in identifying lessons learned to enable a smooth transition to wider DL implementation.

ARI is also supporting an assessment of the practicality of using the Internet for DL. The specific target of this assessment is an aviation weather module for the 93P MOS (Aviation Operations Specialist). Although data collection related to TRADOC applications is in progress, preliminary results show that DL techniques produce achievement levels comparable to those found for institutional training.

Chapter 5: Overcoming Attrition

Relatively high attrition levels (see Chapter 1), a shrinking candidate pool, diminishing national interest in military service, and an increasing demand for persons with advanced technical aptitudes have heightened Army interest in how best to recruit and retain high quality soldiers in both the AC and RC. To help answer this question, ARI has conducted a considerable amount of attitude and opinion survey-related research. Although most of this research has focused on the AC, some of it has attempted to answer RC-specific questions such as (a) who tends to leave, (b) what determines job satisfaction, and (c) what aspects of family support need to be improved and how. This chapter summarizes the findings resulting from this work.

Who Tends to Leave the RC?

The New Recruit Surveys

In the early '80s, ARI began development and yearly administration of the New Recruit Surveys (NRS) at the request of the Staff Director of the Sixth Quadrennial Review of Military Compensation. (Later on in the decade, the U.S. Army Recruiting Command took over NRS administration and analysis). These surveys asked questions about recruits' enlistment decisions (See Table 5-1 for a sample of topics covered.) and have both helped U.S. Army Recruiting Command evaluate the effectiveness of Army advertising and provided guidance to recruiters on effective strategies for influencing a prospect's enlistment decision. Although cross tabulations of RC-specific responses to NRS questions have been published (e.g., Westat, Inc., 1986a, 1986b, 1986c), the results are not summarized. Research by Dale (1989), however, has linked NRS data with subsequent data on RC soldier separation from the Army. This research is summarized below.

Approach

The NRS was administered to 1,683 nonprior service USAR accessions and 2,752 ARNG accessions, who were processed through seven Army reception stations during May and June, 1982, to determine the primary characteristics of soldiers who left the RC between 1982 and 1987. Dale (1989) then merged the resulting data with those from the Reserve Components Common Personnel Data System to determine the extent of soldier attrition that occurred between the 1982 survey and mid-1987. Records for 1,638 of the original 1,683 USAR respondents, and 2,375 of the original 2,752 ARNG respondents were successfully matched with Reserve Components Personnel Data System records.

Table 5-1. Sample NRS Topics	
Section Title	***Topics Covered***
Background	Individual history Family history Marital history
Experience	Educational experience Types of schools attended Highest grade completed Labor force experience Number of employers Income before enlisting
Enlistment	Term of enlistment Whether recipient of enlistment bonuses or Army College Fund Whether initial Army contact made through mail-in coupons Recruiter contact
Decision making	Reasons for enlisting Post-accession plans

Attrition was defined as separation to become either a civilian or a member of the IRR. The specific question to be answered was to what degree attrition in the RC depends on employment status at enlistment, stated career intentions, receipt of enlistment bonuses or Montgomery G.I. Bill benefits, educational aspirations, and grades achieved in school.

Findings

No attrition rate differences were found on the basis of gender. Female sample sizes were relatively small, however, so definite conclusions could not be drawn. As expected, male and female RC members, who said that they planned to leave the Army after their initial enlistment, had higher than average attrition rates. Interestingly, soldiers who indicated that they planned to stay in the military after their initial enlistment had the same attrition rates as soldiers who indicated that they didn't know what their future plans were.

No attrition differences were found between soldiers who enlisted for reasons of money or education, or among soldiers who had different levels of educational aspirations. Family status was also found to be ineffective as a predictor of attrition, as no differences were found except for single parents. Soldiers who had low grades when last in school, however, did have higher than average attrition rates regardless of gender.

In regard to employment, a high number of soldiers indicated that they enlisted because of their inability to find a civilian job. Those same soldiers had significantly higher than average attrition rates.

For male ARNG soldiers, enlistment bonuses were associated with lower attrition rates. Sample sizes for male USAR and female USAR/ARNG members were not large enough to draw additional definitive conclusions. The results of previous research (Grissmer, & Kirby, 1985), however, suggest that enlistment bonuses are likely to have only a marginal effect on attrition rates for male USAR members. Results reported by AmerInd, Inc., 1997a, support this suggestion but also reveal that other incentives related to education, retirement, and medical supplements are likely to reduce attrition among USAR TPU members.

Conclusions

Several clear policy implications were derived from the findings of this research. First, Army efforts to recruit high-quality enlistees should also reduce attrition. Second, offering enlistment bonuses should reduce attrition rates somewhat, at least among male ARNG soldiers. And third, while RC soldiers with intentions to leave the Army after their first enlistment term had higher than average attrition rates, the Army has been successful in retaining soldiers who were unsure of their future plans, because they left at the same rate as those who planned to leave. Further research is needed to determine the reason(s) for this success.

Predicting Job Satisfaction

The Army Experience Survey

In a May 28, 1990, *Washington Post* article, then Secretary of the Army, Marsh, noted that over the next 6 years the AC can expect to lose an annual average of more than 5,000 NCOs and 10,000 commissioned officers through normal attrition and involuntary separation. Some of these prior service soldiers will opt to join the RC, thereby helping to preserve the quality of the Total Army to the maximum extent possible. The likelihood of prior service soldiers choosing to transition from the AC to the RC, and then choosing to remain in the latter, will depend to a large extent on how satisfied they were with their prior AC jobs and how satisfied they are with their subsequent RC jobs (Lakhani, 1990).

To assist the Army in its quest to provide job satisfaction, and thereby increase its chances of retaining high-quality soldiers via AC to RC transition, ARI conducted the 1985 Army Experience Survey (AES) (Westat, 1986a, 1986b, 1986c) to identify the determinants of job satisfaction specific to the USAR and ARNG. An RC-specific model of job satisfaction was then developed to guide planning initiatives of the Deputy Chief of Staff for Personnel's Community and Family Support Center.

Approach

Survey data were gathered from a sample of prior service enlisted soldiers who had joined RC units after leaving the AC. Participants were asked about how satisfied they were with their AC and RC jobs and with the military environment in general. Statistical procedures were used to identify which factors were related to job satisfaction and to develop a predictive model.

Findings

In general, RC soldier job satisfaction tended to be higher for survey respondents who (a) were patriotic, (b) attributed enhanced personal development (e.g., increased self-confidence, job skills, self-discipline, and the ability to work well with others) to prior AC service, (c) had enlisted initially in the AC to obtain education benefits or to earn money for school, (d) were satisfied with their spousal relationship, (e) had received bonuses to enlist or had increased their income since joining the RC, and (f) intended at the time of their AC enlistment to make the Army a career. Not surprisingly, in contrast, job satisfaction among RC soldiers tended to be lower for respondents who also reported being dissatisfied with their prior AC experience. Some of the reasons for soldier dissatisfaction included officers who don't care about their troops, low pay, long working hours, no credit for good work, too many rules, unfair treatment, inadequate training, and uninteresting work.

Conclusions

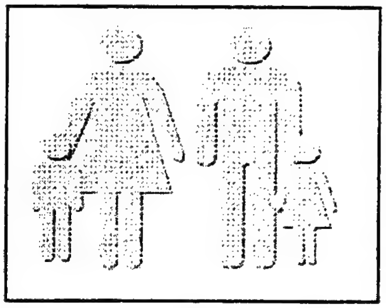
The above findings suggest where the Army might concentrate its efforts to ensure job satisfaction among soldiers who opt to serve in RC units after leaving the AC (and probably for those who decide to remain in the AC as well). Current AC efforts, for instance, to support soldier development, to offer enlistment bonuses, and to foster positive family impact should continue to make a positive difference.

Improvements to the military working environment are also likely to promote subsequent RC job satisfaction. According to survey respondents, such improvements should involve increasing leader concern for, and equitable treatment of, their soldiers, reducing work hours, giving credit for good work, providing appropriate training, and eliminating unnecessary rules.

Job satisfaction might also be improved by extending AC programs to the RC (e.g., quality health care at a reasonable cost, childcare and development services, youth programs, family advocacy, and recreational programs). Such changes are likely to encourage prior service soldiers to participate and remain in the RC after their AC separation. This not only would provide AC soldiers with an opportunity to continue their military careers, but also provide dividends in RC readiness through enhanced prior service accessions.

Looking Out for the Family

The Army Family Research Program



Although the Armed Forces share certain characteristics with other occupations, they are nearly unique in terms of the demands they place on their members and their families. Within the Army, these demands include, for instance, the risk of injury and death, frequent relocation, separation from family, long and often unpredictable duty hours, and residence in foreign countries. Further, the military environment is characterized by masculine norms (e.g., hierarchy, dominance, power, control of emotions) that are often in conflict with family life.

Because soldiers with unhappy spouses or children will themselves become dissatisfied with Army life and, consequently, may not perform well on the job (Lakhani, 1989), it behooves the Army to provide formal support services to ensure that soldiers and their families remain as satisfied as possible. Thus, the Army Family Research Program (AFRP) was a research effort by ARI to identify areas of dissatisfaction and provide recommendations for amelioration.

Approach

The following five surveys were developed and administered to USAR and ARNG soldiers and their spouses to assess their attitudes and concerns about RC service (e.g., Westat, Inc., 1990a, 1990b).

- 1986 Department of Defense ARNG Spouse Survey
- 1986 Department of Defense USAR Spouse Survey
- 1986 Department of Defense RC Member Survey
- 1988 USAR TPU Soldier Survey
- 1988 TPU Attritee Survey

Findings

The findings of these surveys indicated that ARNG and USAR spouses were concerned about long-term benefits of RC service and what would happen if mobilization were to occur. Spouses of RC soldiers wanted more information on mobilization, although few thought that mobilization was likely. Most families reported being ill-prepared for mobilization, although spouses of higher-ranking RC members were relatively better prepared than spouses of lower-ranking RC members.

Many spouses were also unaware of Army family support programs, but ARNG spouses were more knowledgeable of these programs than were USAR spouses.

Whether they were aware of these programs or not, however, few RC spouses intended to use family support centers if mobilization were to occur.

Both RC members and their spouses reported that absence from the family was a significant problem. The most common spousal complaints included unpredictable training schedules, training during special occasions and family vacations, and extra duties. RC members complained that extra duty and IDT/AT were the causes of most family conflicts. ARNG spouses reported slightly more military/family conflicts than those reported by USAR spouses and were more likely to feel that military duties caused problems. In spite of the concerns cited, both RC members and their spouses favored continued participation in the RC. Spousal influence was more important in members' decisions to leave the RC than in their decisions to stay.

Conclusions

These findings suggest that the Army should continue to identify the needs of RC families and address these needs in the following ways:

- Establish and/or improve existing support programs to increase family preparedness for mobilization.
- Increase awareness of existing RC family support programs and their benefits
- Establish and maintain predictable training schedules.
- Educate unit leaders on how to identify and solve problems faced by RC members and their families.

Recently, ARI has published a family support sourcebook to help expedite these recommendations (Bell, Stevens, & Segal, 1996).

Attrition After National Training Center, Reforger, and Blazing Trails Exercises

The Army has taken several steps to raise training readiness of the RC. These include providing improved weapons and training equipment, increased levels of full-time manning, increased pay and benefits in the form of enlistment and reenlistment bonuses and improved G.I. Bill educational benefits, and an increase in the number and type of training opportunities provided. The latter has included increased participation in combat training at the NTC, European (Reforger) mobilization exercises, and construction and logistics exercises in Central America (Blazing Trails).

Grissmer and Nogami (1988) have found that (a) additional RC training time results in negative wage rates because of lost civilian income, and (b) ARNG units

participating in NTC rotations had a 25% higher attrition rate than those units not participating in NTC rotations. Thus, it appears that many soldiers are choosing to leave the RC rather than sacrifice their civilian income because of additional training demands. Seemingly, additional training time may increase RC readiness, but it can also result in increased attrition. Additional research was needed to determine the cause of this elevated attrition rate and whether or not similar attrition losses occur after participation in other special training exercises.

Approach

To this end, ARI conducted a follow-up study to the Grissmer and Nogami (1988) work that empirically examined the attrition rate of RC units participating in NTC, Reforger, and Blazing Trails and compared it to that of similar units not participating in these additional training opportunities (Grissmer, Kirby, & Nogami, 1990). As part of this effort, interviews were conducted with various unit members for the purpose of gathering information pertaining to the unit itself, personnel, exercise preparation and execution, recovery, civilian/employer issues, family issues, compensation issues, and specific unit issues (including attrition).

Findings

The data showed that RC units that participated in these additional training opportunities tended to have higher soldier attrition rates than those of nonparticipating (comparison) RC units (see Table 5-2). This difference was most pronounced for NTC rotations where units typically undergo a year-long train-up and 3 weeks of AT rather than the normal 2 weeks. Reforger, in contrast, requires 3 weeks of AT, but no additional train-up period, and Blazing Trails requires less than 3 weeks of AT and minimal extra preparation time.

Suggested reasons for this increased attrition rate included: (a) family conflicts, especially among junior enlisted soldiers and mid-level officers, resulting from the need for extra AT time, (b) employer conflicts resulting from soldier/employee work absences during AT participation, (c) loss of pay opportunities because of additional time spent on military training, and (d) implementation of higher physical and task performance standards.

Conclusions

The above findings suggest that RC participation in additional training opportunities designed to increase readiness also have a negative impact on attrition. Many soldiers understandably choose to leave the RC rather than jeopardize their family situation and civilian job. By finding ways to reduce family and civilian job conflicts associated with increased training opportunity participation, the Army will maximize its chances of having both a ready and up-to-strength RC.

Table 5-2. Attrition/Transfers in NTC/Reforger/Blazing Trails Versus Comparison Units Over an 18-Month Period.	
Type of Unit	***Unit Attrition (%)***
NTC units	29.95
Comparison Units	22.57
Reforger Units	28.42
Comparison Units	26.72
Blazing Trails Units	31.53
Comparison Units	30.62

CHAPTER 6: What We Know From Deployments

A significant portion of ARI's RC-specific work program has been devoted to assessing the impact of RC participation in overseas deployments. Past work has included two assessments of Operation Desert Storm (ODS) mobilization impact on RC members and their families, and a recent comprehensive look at the first deployment of a composite AC/RC unit for a 6-month rotational peacekeeping mission in the Sinai Peninsula. Similar work, to be published in 1999, is underway to assess the impact of Operation Joint Endeavor mobilization (Steinberg, personal communication, October 28, 1997).

In general, our deployment-related research has uncovered important findings of use to AC/RC planners and policy makers alike as they ponder the pros and cons of placing RC soldiers on prolonged active duty assignments. Many of the resulting recommendations have been implemented or have led to future research. This chapter summarizes the work from which these recommendations have come.

RC Soldier Reactions to the Operation Desert Storm Call-Up

As part of the 1991 Surveys of Total Army Military Personnel (STAMP), ARI conducted a Survey of Mobilized Reservists to examine RC soldiers' mobilization experiences, as well as their perceptions of unit morale, readiness, leadership, and training during ODS (Harris, Elig, & Oliver, 1992).

Approach

The 124-item survey was distributed to a stratified random sample of 1200 reservists (from which 618 [51%] surveys were eventually returned). Stratification was based on military personnel classification (enlisted, commissioned officers, and warrant officers) and location of deployment (Continental U.S. [CONUS], and other than CONUS [OCONUS], but not including those soldiers deployed to Southwest Asia.

Findings

Although respondents were satisfied with the ODS call up, thought that mobilization and deployment went well, and were confident in their ability to perform in battle, some problems areas were reported (Table 6-1). Respondents gave their leaders

negative evaluations. Only about half agreed, for instance, that their leaders would perform well in combat or that they were genuinely concerned about soldiers and their families. About half also indicated that they were underused during the call-up period. This left many feeling that they had been taken from their families and civilian jobs for no apparent reason. Enlisted soldiers were more likely than officers to complain about the accuracy of their pay and allotments, while both tended to agree that the availability of personnel, medical, and dental records declined substantially during their call-up.

Table 6-1. Identified Problem Areas
o Disorganization during in-processing
o Lack of information
o Poor treatment by AC
o Problems with pay and allotments
o Loss of income/employment
o Inadequate leadership
o Underuse

Many respondents also reported that they lost income as a result of being called up. Those who worked for larger companies (i.e., >100 employees) often reported receiving supplemental income and continued health benefits while deployed, whereas those who worked for smaller companies typically did not report receiving such supplemental benefits. Self-employed soldiers were more likely to be adversely impacted by the call-up, with 36% thinking that it would take about 6 months to recover financially, and 29% expecting to be out of a job when deactivated because of the inability to find a replacement during their deployment.

RC soldiers also felt that (a) they did not receive accurate and timely information on the progress of military operations and on events impacting their ability to keep families and employers apprised of their personal situation, (b) their in-processing was disorganized, and (c) they were not treated like equals by the AC.

Conclusions

The above findings provide RC mobilization policy makers with needed information on RC soldier ODS call-up experiences that could increase stress and uncertainty, decrease morale and unit cohesion, and negatively impact performance,

readiness, and future recruiting. These findings have been included in Army Inspector General reports and used in lessons-learned reviews of mobilization policies and procedures for the drilling and inactive reserves. The USAR and ARNG have used these findings in recruiting and retention policy reviews and planning conferences. In addition, the American Red Cross has used these findings to plan the disbursement of $13.5 million in a federally funded effort to reduce the personal financial burdens of mobilized reservists from all services.

IRR Soldier Reactions to the Operation Desert Storm Call-Up

The IRR segment of the USAR is primarily comprised of individuals who formerly served with an active or reserve unit and are now "on call" to be mobilized. Although IRR soldiers do not receive formal training (aside from voluntary periodic refresher training [see Chapter 2] and that received just prior to deployment) they presumably still remember how to perform a significant portion of the tasks once performed on prior active or reserve duty. Therefore, IRR soldiers can make a significant contribution to Army needs during times of national crisis. In 1991, ARI took the opportunity to survey IRR soldier reactions to being called up for ODS.

Approach

A 31-item survey was developed specifically to assess IRR soldiers' reactions to being called up, the adequacy of in-processing, training, and medical treatment, and the equality of treatment received from the AC (Steinberg, 1991). The survey was distributed by TRADOC mobilization stations responsible for in-processing and testing, and completed by 3,051 respondents as part of their out-processing just prior to deployment.

Findings

Most respondents reported being dissatisfied with their call-up experience (Figure 6-1). Their reasons are summarized in Table 6-2. Two major dissatisfactions, for example, included the lack of organization during in-processing (e.g., long lines, inability of AC personnel to answer questions about in-processing procedures, sent to more than one location) and being poorly treated by those in charge (e.g., not treated with respect, being lied to, locked in barracks overnight, given curfews). Respondents also complained of inappropriate/inadequate training (e.g., lack of emphasis on tasks related to their MOS, wasted time, training that was too easy to pass) and poor medical screening (e.g., having to take unnecessary shots because records were lost). Complaints were also reported in a variety of other areas, to include problems receiving pay, loss of income as a result of being called up, and not enough notice given prior to being called up.

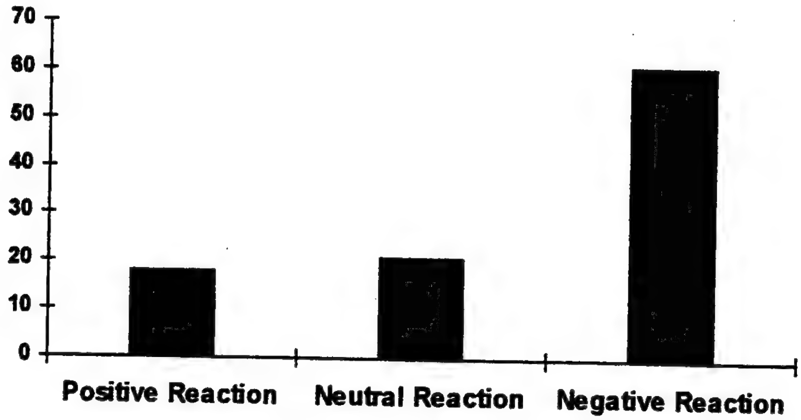


Figure 6-1. Percentage of IRR soldiers exhibiting each reaction upon being called up.

Table 6-2. Reasons for Dissatisfaction with ODS Call-Up.
o Disorganization at in-processing
o Lack of information
o Poor treatment by those in charge
o Inappropriate/Inadequate training
o Problems receiving pay
o Poor medical treatment
o Not enough notice prior to being called up

ARI attempted to identify the variables that did and did not predict which soldiers had a positive or negative attitude toward being called up. Table 6-3 reveals all variables that discriminated between the groups were directly related to the Army while the majority of variables that did not discriminate were associated with personal and family issues. Figure 6-2 depicts the relationship between the soldiers' attitudes toward being called up and their attitudes toward active Army service upon leaving. In general, call-up dissatisfaction was related to IRR soldiers' dissatisfaction with their prior Army experience (Figure 6-3) and not to personal and family concerns.

Table 6-3. *Variables That Did and Didn't Predict Call-Up Dissatisfaction*	
Predictors	***Non-Predictors***
Attitude toward Active Army service upon leaving	Marital status Number of children
Attitude toward primary MOS during previous duty	Dependents Supported Job
Technical ability (after retraining) to perform Army job	Personal Income Change School
Motivation to perform Army duties	Time in IRR
Confidence in ability to perform well in combat situations	Age Rank

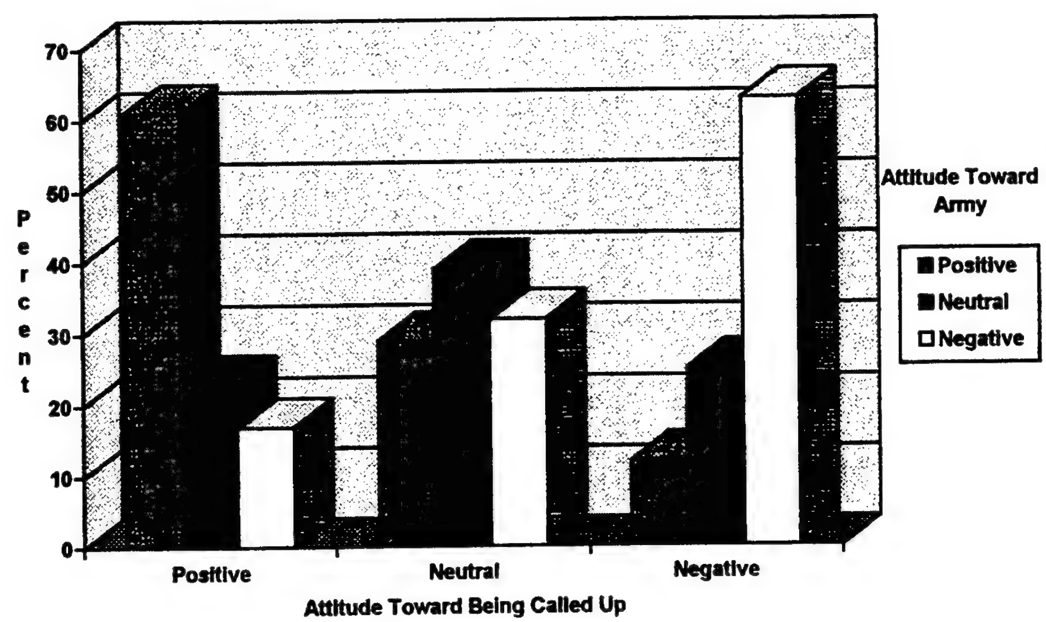


Figure 6-2. Relation between attitude toward being called up and attitude toward active Army service upon leaving.

Conclusions

The above findings suggest several actions that could be taken to improve IRR satisfaction with the call-up process. In-processing, for example, could be improved by establishing effective and efficient procedures for processing large numbers of soldiers concurrently, organizing work stations to maximize the number of people to be processed each day, ensuring that in-processing personnel are trained and capable of answering

questions, and eliminating the need for soldiers to be in-processed at more than one location.

It is equally important that training time be maximized at in-processing stations. For example, if a soldier is assigned to a new MOS at call-up, then it is essential that training be adjusted to accommodate this inexperience. Additionally, guidelines need to be established for the purpose of training at in-processing stations. If the goal of training at in-processing is recertification, then it is important to communicate this intent to the soldiers and assure them that there will be more in-depth training or situation-relevant training to follow.

Finally, it is important that the Army be cognizant of the disruptions in soldiers' personal lives that occur as a result of being called up. Survey respondents suggested that the Army offer information about services and support groups to help spouses cope with the additional burdens placed upon them. Additionally, it was felt that distribution of financial information would have helped families cope with the economic strain. Focusing on these actions will allow the Army to maximize the potential of IRR soldiers and ensure the success of future mobilizations involving their participation.

Peacekeeping in the Sinai

Faced with an increasing need for troop support in world-wide peacekeeping missions at a time when reductions in force strength are taking place, the Army is exploring ways in which RC soldiers can be used to fulfill some of its peacekeeping commitments. One peacekeeping mission for which the U.S. has deployed an infantry battalion for 6-month rotations since 1982 is the Multinational Force and Observers (MFO) mission in the Sinai Peninsula.

The purpose of this mission is to observe and report violations to the 1979 Egyptian-Israeli Treaty of Peace resulting from the previous year's Camp David Accords. The U.S. is responsible for observing the area of operation in the southern part of the Sinai bordered by the Gulf of Aqaba and the Strait of Tiran (Figure 6-3). In performing this mission, U.S. peacekeepers typically spend 3 weeks at a remote observation/control site, 3 weeks at base camp, and then rotate back to the same remote site.

In response to a request from the Army Chief of Staff, the Army examined the feasibility of recruiting qualified RC volunteers and deploying a battalion-sized peacekeeping unit composed of AC and RC soldiers for duty in the Sinai (Phelps & Farr, 1996). This composite "test" battalion was activated in November 1994 and inactivated in July 1995. As shown in Figure 6-4, it was composed of 80% RC and 20% AC soldiers. The officer and NCO positions were equally divided between RC and AC, with most junior enlisted positions filled from the RC.

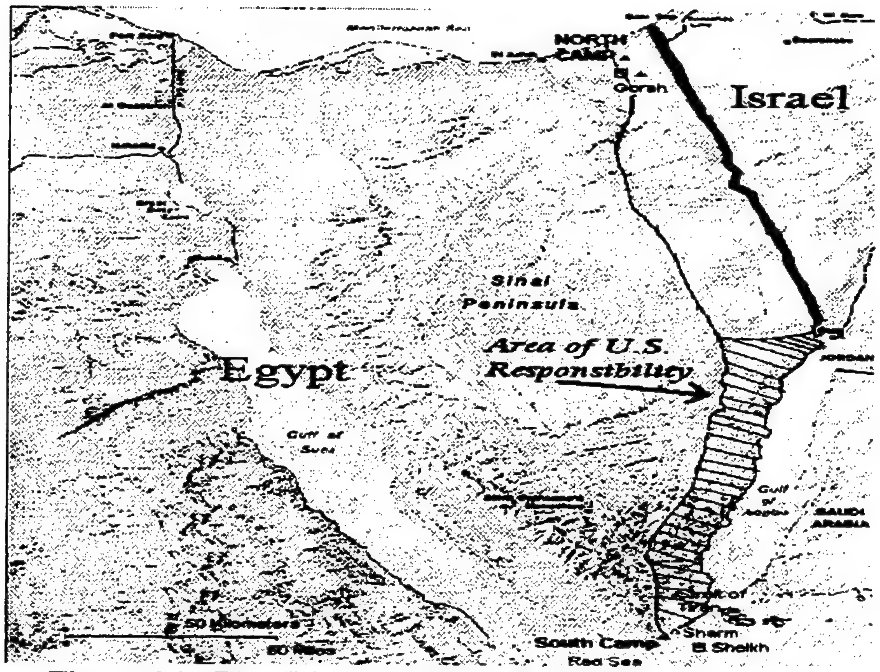


Figure 6-3. The U.S. area of peacekeeping responsibility.

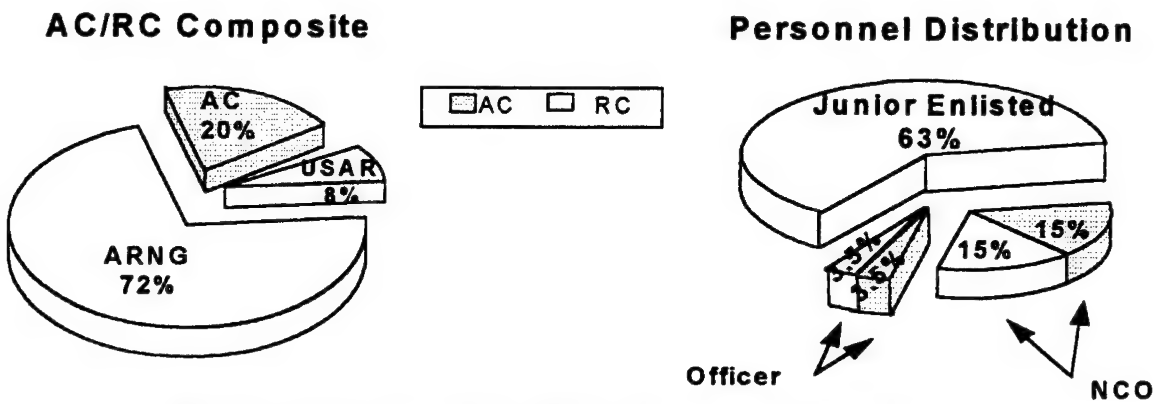


Figure 6-4. Composition of the peacekeeping battalion.

Approach

ARI examined the process used to recruit and screen the RC peacekeepers (Figure 6-5), their predeployment training, unit cohesiveness, morale, and the effectiveness of support given their families.

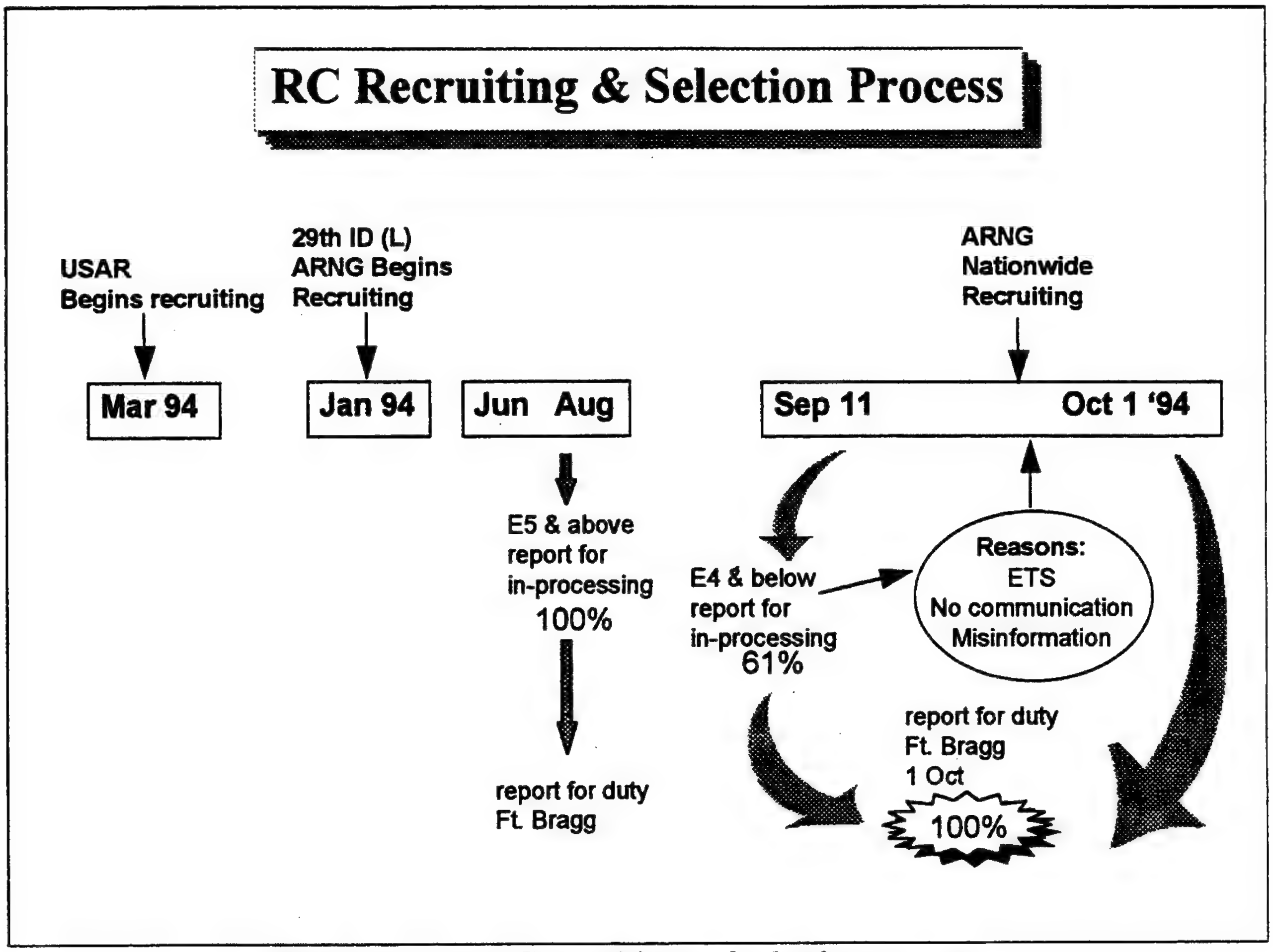


Figure 6-5. The RC recruiting and selection process.

A longitudinal case study approach was adopted in which survey instruments and interview protocols were developed and administered to soldiers, leaders, trainers, and spouses throughout predeployment (at Forts Bragg and Benning) and deployment (in the Sinai). ARI visited the test battalion three times to collect data during predeployment and twice during deployment. Data were collected in five areas:

- ***Personnel***, which covered the recruiting and screening process, reasons for volunteering, and expectations for the peacekeeping experience.

- ***Training***, which covered the types of tasks trained, the length and type of training, and its subsequent effectiveness.

- ***Attitudes and Perceptions***, which covered unit cohesion, morale, and deployment impact on civilian and military lives.

- ***Family Support***, which covered the adequacy of the RC family support system and how serving in the Sinai affected the quality of marriages.

- ***Home-Unit Impact***, which covered readiness, training, and morale changes that occurred in the sponsoring 29th Infantry Division (Light) (29th ID[L]) as a result of the temporary loss of soldiers to the peacekeeping mission.

Results obtained from the AC/RC composite test battalion in the areas of training, unit cohesion, and morale were then compared to those obtained from an all-AC battalion previously deployed to the Sinai.

Findings

Personnel. All of the required 446 RC slots (401 ARNG; 45 USAR) were filled with soldiers meeting the physical and performance standards set by the U.S. Army Forces Command. The screening process for ARNG volunteers was primarily administrative (i.e., records were reviewed) and took place at the brigade, battalion, and division levels. That for USAR volunteers was based on administrative information as well as performance during refresher training at Fort McCoy.

Slightly more than half of the soldiers recruited came from the Maryland and Virginia ARNG (29th ID[L]). The remaining soldiers were recruited from 33 other states. Forty-five percent were employed full time, 20% were unemployed or in school, and 25% were married. Almost all RC soldiers were male and possessed at least a high school education. No differences existed between RC and AC soldiers in terms of age, education, and spousal employment. Soldiers in the two components did differ, however, in their overseas tour experience (most AC soldiers had served overseas before, whereas most RC soldiers had not) and direct combat experience (only 15% of RC soldiers had direct combat experience, whereas almost half of the AC soldiers had such experience).

As shown in Table 6-4, most RC soldiers said that they volunteered for a challenging and adventurous way to serve their country and/or to enhance their military careers. The need for more money and various benefits was rated as a moderately important reason for volunteering, with time out from school/job, family problems, and unemployment rated lowest in importance. About four-fifths of the RC soldiers indicated that they wanted to take educational courses while deployed in the Sinai and almost all RC soldiers planned to travel for recreation when possible.

Table 6-4. Reasons Why RC Soldiers Volunteered

Reason	%
Adventure/Travel	90
Challenge/New Skills	85
Serve My Country	82
Career Advancement	78
Education	61
More Money	55

Lack of periodic communication with volunteers during the several months that elapsed between the time they initially volunteered and the time they were eventually called upon to report resulted in a 39% ARNG no-show rate at Ft. Bragg. The major reasons for not reporting included family (41%), job (14%), and school (14%) commitments made while waiting to be notified of their selection status. Additional recruiting was necessary to make up for the ARNG shortfall. Further, the Army Reserve Personnel Center reported making about 150 calls per volunteer to recruit the USAR's required 45 MFO slots (originally to come solely from the IRR). Of the 39 USAR/IRR volunteers targeted for refresher training at Ft. McCoy, only 10 actually joined the peacekeeping unit. The USAR made up this shortfall by recruiting from its TPUs.

Some hard lessons were learned from this research about how to improve this recruiting process. First, volunteers need to be kept informed of their status during the time they volunteer and the time when the selection decision is finally made (see AmerInd, Inc., 1997b, for supporting conclusions). Because citizen soldiers must consider the needs of others (e.g., spouse, family, employer) as well as themselves, RC soldiers who volunteer several months prior to a mission, and are not kept informed of their selection status, may not be able to report for duty when the time comes. Second, a great deal of effort is necessary (particularly when recruiting IRR volunteers) to identify RC volunteers and to make up shortfalls for "no shows" and those not qualified to deploy. And third, the volunteer screening process needs to be standardized to simplify interpretation and application of peacekeeping mission qualification standards.

Training. Peacekeeping operations require different skills and knowledges than those required for combat operations. In addition, peacekeepers need to be sensitized to local conditions, cultures, and laws before deployment. To assess the extent to which peacekeeper training accomplished these goals, special tests were developed and then administered at the end of predeployment training and during deployment.

Overall, results showed that the AC/RC test battalion was as prepared as a prior all-AC comparison battalion to accomplish the peacekeeping mission. Further, the 3 months of training received by the test battalion during predeployment was judged to be comparable to that received by a (then) recent all-AC battalion before it was deployed to the Sinai. Moreover, the level of test battalion knowledge required to perform MFO and soldiering tasks remained comparable to that of the comparison AC battalion throughout the rotation. However, because there was no previously established unit cohesion, two additional months of training were required for the test battalion's leaders in garrison and at the Fort Benning Infantry Leader's Course (ILC).

Results of predeployment training assessment produced several recommendations. First, the time allotted to ILC should be decreased or replaced by training that focuses on peacekeeping-specific rather than combat-related infantry tasks. Second, ensure that the unit leadership is provided with a "big picture" overview of the peacekeeping mission. And third, eliminate the IRR training conducted at Fort McCoy because of its minimal payoff (i.e., only 28% of attendees eventually deployed) and redundancy with subsequent training provided at Ft. Bragg.

Perceptions and Attitudes. Although test battalion soldiers had not previously served together, their unit cohesion approximated that of a prior all-AC rotation. An analysis of survey and interview data showed that RC soldiers worked as well, or better, with AC leaders than they did with RC leaders. Also, squad member cohesion and job performance were not affected by the requirement for soldiers from different components, or from different units/states, to work together.

Although unit cohesion was perceived to be high, a decrease in soldier morale over time was noted. In general, RC soldiers who volunteered for patriotic reasons tended to have higher morale than those who volunteered for monetary reasons. Officers tended to have higher morale than that of enlisted soldiers, and RC volunteers tended to have higher morale than that of AC soldiers. Although morale decreased over the course of the mission, this deterioration did not interfere with unit performance. It did, however, negatively impact soldiers' attitudes toward future peacekeeping mission participation and future military service in general. As the mission wore on, fewer RC soldiers indicated willingness to volunteer for future missions or expressed an intention to remain in the military. It appears that this erosion in morale resulted from discrepancies between expectations formed during the recruitment process and what was actually experienced during the mission (e.g., educational opportunities were fewer, costs were higher).

Family Support. Although only about one-quarter of test battalion soldiers were married, their families were located in 26 different states (Figure 6-6) with half living more than 50 miles from the nearest AC military installation. To ensure support was provided when needed, ARNG family coordinators were notified of families in their states and provided with MFO-related assistance information. The test battalion's commander assigned an ARNG family assistance officer (FAO) full time to the stateside rear detachment. In addition, a telephone line was established (although late in the deployment) to help soldiers maintain family contact, and copies of the *Family Support Handbook* (Bell, et al., 1996) and battalion newsletter were distributed.

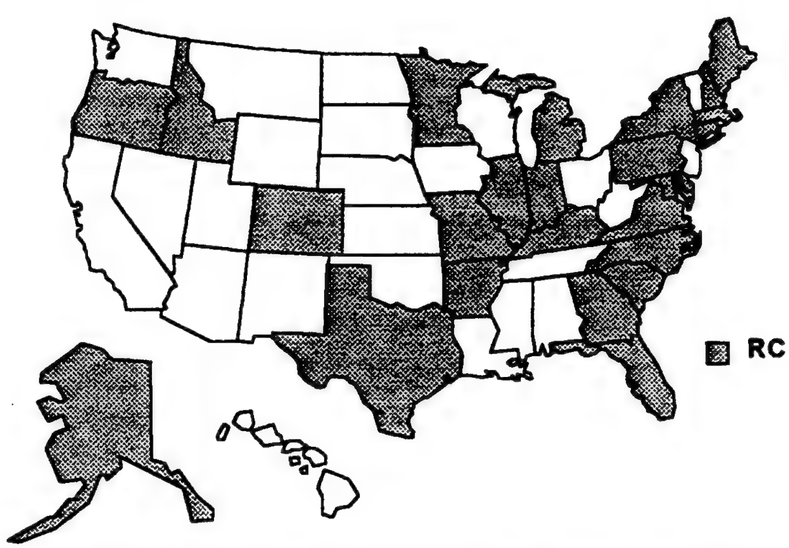


Figure 6-6. Location of RC peacekeeper spouses.

Responses to surveys and interviews indicated that RC spouses received support primarily from other family members and non-Army friends. Spouses who did use the Army's family support system, however, said that they generally were satisfied with the help provided.

Soldiers and their spouses reported small decreases in marital stability and satisfaction, but an increase in marital quality. Interestingly, it was the soldiers who complained of a lack of spousal support and the feeling that family concerns were interfering with their work. Because it was the soldiers rather than their spouses who complained of family interference and lack of support, future Army "fixes" should include advice and support to deployed soldiers as a way to increase/maintain soldier performance and morale.

Home-Unit Impact. The 29th ID (L) contributed the majority (294) of the composite test battalion's RC volunteers. To assess the impact of this contribution, 71 senior leaders from the division's nine contributing infantry battalions were surveyed twice (i.e., 60 and 170 days after unit deployment) and interviewed once (i.e., about 90 days after volunteers had returned home), and 875 junior leaders and soldiers were surveyed once (120 days after unit deployment) .

An initial negative impact on combat readiness and training was reported by senior leaders, with greater impacts reported by leaders who lost more troops to the mission. These same leaders, however, reported positive mission impact on combat readiness and training by the time the volunteers had returned to their units. Further, almost three-fourths of the leaders reported that the volunteers were better trained upon returning to the units after having participated in the peacekeeping mission.

Overall, the 29th ID(L) was proud to have been chosen to sponsor the peacekeeping mission. After mission completion, home-unit morale was reportedly higher and nearly all junior and senior leaders endorsed future RC participation in similar peacekeeping missions.

Conclusions

The above findings suggest that RC and AC soldiers can be successfully integrated into a composite unit for the purpose of peacekeeping. Consideration of the following lessons learned will allow the use of RC volunteers to remain a feasible option for the Army to entertain as it attempts to meet its overseas peacekeeping responsibilities:

Personnel:

- Maintain more frequent communication with RC soldiers who volunteer for similar types of missions to keep them abreast of their status in the selection process.

- Identify in advance, and communicate in writing, exactly what the conditions, opportunities, and benefits are for the RC peacekeeping volunteer.

Training:

- Emphasize peacekeeping tasks during soldier and leader training so that predeployment time can be shortened.
- Use peacekeeping training rather than the ILC to build cohesion.
- Develop unit measures of peacekeeping performance.
- Include command and control synchronization training, possibly by using simulations and simulators.

Attitudes and Perceptions:

- Train leaders to recognize problems unique to peacekeeping assignments, such as boredom and isolation, that may lead to morale problems.
- Increase the frequency and accuracy of information provided during recruitment and training phases so that soldier expectations can be more realistic.

Family Support:

- Ensure family support remains a high priority throughout peacekeeping missions.
- Assign family support providers as geographically close to families as possible.
- Maximize the use of existing family assistance programs.
- Ensure family addresses and telephone numbers are accurate.
- Allow each soldier at least one free phone call home per month to increase morale.

Home-Unit Impact

- Draw volunteers from the largest pool possible so that the number of soldiers taken from any one supporting unit is limited.
- Take advantage of the morale benefits that result from participating in volunteer peacekeeping missions such as that conducted in the Sinai.

Chapter 7: What's the Payoff?

So how does the RC benefit from all these R&D products? In general, we believe the payoff to be substantial and necessary for the RC to meet readiness challenges stemming from the interrelated constraints of limited training time, geographical dispersion, and personnel attrition that exist within the RC's unique operational environment. In this final chapter, we present some of the reasons for our belief and, in doing so, provide examples of how particular products can be used to minimize the negative impact of these constraints on RC efforts to attain and maintain readiness.

Overcoming Time Constraints: TADSS-Related Products

Perhaps the most significant payoff from our research has come from the development of TADSS-related products designed to help the RC make the most out of the limited time (i.e., 38/39 days) available for training each year. In general, these products allow RC unit leaders/trainers to do things now that they've never been able to do before, and to do them more effectively and efficiently.

Individual and Crew-Level Training

In the area of individual- and crew-level training, leaders/trainers can now predict individual/crew-served weapons live-fire performance with the use of TADSS. This predictive capability can lead to live-fire ammunition savings through the targeting of unlikely first-run qualifiers for remedial training before their arrival on the live-fire range. It also allows the value of a "pound of training" to be calculated by plotting expected live-fire outcomes/costs for different levels of TADSS-based proficiency. The capability to predict live-fire performance from TADSS-based performance also suggests that TADSS could be used, in place of live-fire, for yearly individual/crew-served weapons qualification when outdoor range facilities are lacking or subject to restricted access.

Our strategy-related products go a step farther by showing just exactly how to incorporate these predictive capabilities within a proficiency-based, TADSS-oriented training program that ensures the most effective/efficient use of limited training time. These strategies are easy to implement at the unit (company) level and provide specific guidance on how, for whom, on which TADSS, and for how long training should be conducted for best results.

Our newly developed software prediction program can not only support the above training goals, but also the making of future TADSS procurement decisions. One could argue, for example, that no procurements should proceed until the performance of prospective TADSS has been shown to predict performance on the live-fire weapons

system(s) being simulated. Our software program enables this predictive relation to be calculated quickly and accurately *before* a final procurement decision is made, thereby minimizing the chances of fielding TADSS that don't "work" as advertised.

Unit Tactical and Battle Staff Training

In the area of unit tactical and battle staff training, our development of TADSS-related products has extended RC capabilities to train tactical skills at the company- through brigade-level, and individual and synchronization skills at the battle staff level. This training capability exists at Fort Knox's Mounted Warfare Simulations Training Center and can be exported via long-distance distributed communications technologies to a unit's home station for use during weekend drill periods. Consequently, the RC can now conveniently train via TADSS at the local armory or reserve center in a collective mode at organizational levels never before possible. Such TADSS-based training promotes effectiveness and resource efficiency to the extent that either more task repetitions, more task variety, or more of both are possible for a given amount of time and money, thereby maximizing the levels of task/skill acquisition, retention, and transfer produced from the resources (e.g., time, OPTEMPO costs) expended.

Overcoming Dispersion Constraints: DL-Related Products

The impact of unit/soldier geographical dispersion would not be a problem for the RC if it weren't for the added resources (e.g., time and money) needed to bring soldiers together for training. The payoff from our DL-related products, therefore, stems from their ability to bring training to soldiers, instead of vice versa, thereby reducing, and in some cases even eliminating, the need for added resource expenditures. In general, these products demonstrate that many of the traditional RC training challenges associated with geographical dispersion of units/soldiers can now be overcome via DL. Indeed, by using DL, the RC can make better use of available training time by minimizing unproductive travel time and costs without sacrificing training effectiveness. More specifically, our research has shown ACC to be an exciting new approach to DL that can substantially increase the availability of training by enabling such training to be worked successfully into RC soldiers' busy schedules.

By-products of this work provide training course developers with needed background information on what sort of DL-related research has been done elsewhere in the past, and the kind of practical knowledge required for future successful design, development, and implementation of ACC as well as other DL approaches. And lastly, our more recent work has given the RC a boost toward the timely establishment of a nation-wide network of DL classroom sites by developing (a) an inventory of currently available DL courseware, (b) criteria for prioritizing courses for DL, (c) guidance on how to convert resident courses and evaluate their effectiveness/efficiency, and by (d) exploring the practicality of using the Internet for training purposes in the future. Once this network is established, RC soldiers will be within a 60-mile commute of a DL classroom.

Overcoming Attrition: Attitude and Opinion-Related Products

The challenges posed by limited training time and geographical dispersion are exacerbated by soldier attrition. Each time a soldier leaves the RC, a new one must be recruited and trained. This takes time and tends to reduce the overall level of training provided in the unit to accommodate soldiers with only entry-level skills. This has the potential effect of causing soldiers already in the unit to become dissatisfied with their less-than-challenging training, thereby further contributing to attrition. Thus, a thorough understanding of RC attrition is needed to guide future Army efforts to retain quality RC soldiers in the face of an ever-shrinking candidate pool.

To this end, our RC-related attitude and opinion survey research has provided the Army with a better understanding of which soldiers are likely to leave the RC, and why. Much of the information provided by our research has clear policy implications for actions that could be taken to reduce RC soldier attrition and, thereby, minimize the need for training new accessions. Our findings have shown, for example, that many of the actions already being taken by the Army to recruit high-quality enlistees (i.e., enlistment bonuses, incentives related to education, retirement, and medical supplements), should also have a beneficial effect on attrition. In addition, actions designed to enhance AC job satisfaction (e.g., increased leader concern for soldiers/families, extension of AC low-cost health care programs, child care and development services, youth programs, family advocacy, and recreational programs to the RC) are all also likely to pay off, especially when measured by the number of prior AC soldiers transitioning to the RC. Lastly, our research suggests that the AC must come to grips with the fundamental challenge of having to balance the positive impact that additional training opportunities (e.g., NTC rotations) have on readiness with the negative impact that these opportunities also appear to have on RC attrition.

Deployment-Related Products

Although our product development efforts have focused primarily on helping the RC with efforts to both reduce soldier attrition and enhance the effectiveness and resource efficiency of *pre*mobilization training, we've also provided the Army with considerable information on *post*mobilization training and the kinds of experiences reported by RC soldiers during the mobilization process and subsequent deployment overseas. This postmobilization information can help the Army to determine how, and with whom, to train for best results, and to minimize the impact of negative experiences on RC soldier morale, job performance, and willingness to remain in the force.

IRR Mobilization Exercises

Our work with the IRR demonstrates that using a rapid train-up approach involving voluntary prior at-home study can reduce the postmobilization training time needed to achieve Army standards. It also provides Army planners and policy makers with the kind of information needed to select prospective IRR candidates for post mobilization training based on success predictors such as the length of active army

separation time, length of time spent on active duty, and the extent of military-civilian job match. Use of this information should ensure the effectiveness of soldier selection and the efficiency of postmobilization training after call up.

RC Soldier Reactions to ODS Call-Up

In general, our deployment-related research has uncovered useful findings for AC and RC planners and policy-makers alike as they ponder the pros and cons of placing RC soldiers on prolonged active duty assignments. Based on research conducted with RC soldiers called up for ODS, for instance, we've learned that the Army could take several actions that are likely to improve RC soldiers' satisfaction with the call-up process. Actions such as improving the efficiency of in-processing, providing more mission-relevant training at the mobilization site, ensuring better medical screening, and increasing Army sensitivity to the disruptions in civilian life associated with being called up for overseas deployment are just a few of the areas identified by respondents as influencing their satisfaction with the call-up experience. These actions should serve not only to increase the morale and job performance of RC soldiers once deployed, but also to reduce their attrition rate after stateside redeployment.

Peacekeeping in the Sinai

Our ground-breaking research in this area has demonstrated for the first time that RC volunteer and AC soldiers can be integrated successfully into a composite unit for peacekeeping purposes. In addition, our findings from the Sinai mission suggest that RC participation in peacekeeping missions is likely to engender increased pride and morale within units that contribute volunteers and that these units are likely to benefit in the long run from the presence of better trained soldiers upon their redeployment stateside after mission completion. And finally, our work has helped the Army target specific actions needed in the areas of recruiting, training, stateside family support, and home unit impact to better ensure that RC participation in peacekeeping missions remains a viable option for fulfilling U.S. peacekeeping commitments in the future.

A Final Word

In closing, we hope this report has provided a more comprehensive understanding of what ARI has done lately for the RC, as well as the wide ranging impact of the products it has developed. We also hope this report has produced an enhanced appreciation for the scope of work that ARI is capable of performing in the future to support the RC's R&D product needs of the 21st Century.

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Appendix: List of Acronyms

Acronym	*Definition*
AAR	After Action Review
AC	Active Component
ACC	Asynchronous Computer Conferencing
AES	Army Experience Survey
AFIST	Abrams Full-Crew Interactive Simulation Trainer
AFQT	Armed Forces Qualification Test
AFRP	Army Family Research Program
AIT	Advanced Individual Training
ARI	Army Research Institute
ARNG	Army National Guard
AT	Annual Training
BFV	Bradley Fighting Vehicle
BMMO	Brigade Material Management Officer
BN-BSTS	Battalion Battle Staff Training System
BNCOC	Basic Non Commissioned Officer Course
CBI	Computer-Based Instruction
CD-ROM	Compact Disk-Read Only Memory
COFT	Conduct-of-Fire Trainer
CONUS	Continental United States
CP	Command Post
CPX	Command Post Exercise
CS	Combat Support
CSS	Combat Service Support
CTCP	Combat Trains Command Post
DL	Distance Learning
DS	Direct Support
EOAC	Enlisted Officer Advanced Course
EST	Engagement Skills Trainer
FAO	Family Assistance Officer
FSB	Forward Support Battalion
FSO	Fire Support Officer
GS	General Support
ID(L)	Infantry Division (Light)
IDT	Inactive Duty Training
ILC	Infantry Leader Course
IRR	Individual Ready Reserve
JMSE	Janus-Mediated Staff Exercise
LTA	Local Training Area
M-DAY	Mobilization-Day
MACS	Multipurpose Arcade Combat Simulator

M-DAY	Mobilization-Day
MACS	Multipurpose Arcade Combat Simulator
MATES	Mobilization and Training Equipment Site
METL	Mission Essential Task List
MFO	Multinational Force and Observers
MOS	Military Occupational Specialty
MTA	Major Training Area
MTP-RC	Model Training Program - Reserve Component
MUTA	Multiple Unit Training Assembly
NCO	Noncommissioned Officer
NET	New Equipment Training
NGB	National Guard Bureau
NRS	New Recruit Surveys
NTC	National Training Center
O/C	Observer/Controller
OCAR	Office of the Chief, Army Reserve
OCONUS	Other Than the Continental United States
ODS	Operation Desert Storm
OPFOR	Opposing Force
OPORD	Operations Order
PERSCOM	Total Army Personnel Command
QDR	Quadrennial Defense Review
R&D	Research and Development
RC	Reserve Component
RCVTP	Reserve Component Virtual Training Program
S1	Personnel Officer
S2	Intelligence Officer
S3	Operations and Training Officer
S4	Logistics Officer
S5	Civil-Military Operations Officer
SB	Support Battalion
SGT	Staff Group Trainer
SIMITAR	Simulation in Training for Advanced Readiness
SIMNET	Simulation Networking
SIMUTA	Simulation-Based Multi-Echelon Training Program for Armor Units
SME	Subject Matter Expert
SPO	Support Operations Officer
STAMP	Surveys of Total Army Personnel
SWA	Southwest Asia
TADSS	Training Aids, Devices, Simulators, and Simulations
TPU	Troop Program Unit
TRADOC	U.S. Army Training and Doctrine Command
USAARMC	United States Army Armor Center
USAARMS	United States Army Armor School
USAR	United States Army Reserve

UTA	Unit Training Assembly
VTP	Virtual Training Program
XO	Executive Officer